Before the Susquehanna River Basin Commission
Notice of Proposed Rulemaking
Modifying 18 CFR Part 801, Review and Approval of Projects

August 1, 2024

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I. Introduction.

I am Eric Epstein ("Epstein" or Mr. Epstein"), and I have represented Three Mile Island Alert, Inc. ("TMIA") either as Spokesperson or Chairman since 1984. I am respectfully submitting comments in support of the Susquehanna River Basin's Commission's ("SRBC" or "the Commission") Changes to Proposed to Part 81 § 801.12 Electric Power Generation.

> (d) Project sponsors proposing new or significantly modified power generation plants in the basin shall consider the use of dry cooling technologies and submit to the Commission a rigorous alternatives analysis. This analysis shall include evaluation of the costs, benefits, trade-offs and drawbacks of various cooling and water conservation techniques, and a full evaluation of options for providing effective consumptive use mitigation. (1)

> Finally, the Commission proposes the addition of paragraph (d) to § 801.12 related to electric power generation facilities. This new paragraph memorializes and elevates the Use of Dry Cooling Technology for Power Generation and Other Facilities, Commission Resolution Number 2015-02 (Dry Cooling Resolution). The Dry Cooling Resolution has been instrumental in reducing the water consumption of new power plants in the basin. The Commission recognizes that an increasing number of power generation facilities, most recently combined cycle natural gas powered plants, are utilizing dry cooling technology to reduce the environmental footprint in the basin, and are demonstrating overall efficiencies in operations that are equivalent to wet cooling processes. Dry cooling technology significantly reduces the water demand of such facilities and provides increased flexibility in siting facilities in proximity to fuel sources and electrical transmission lines. Use of dry cooling technology reduces impacts to aquatic ecosystems through the reduction of thermal impacts associated with large industrial volume discharges. The proposal would require consideration of dry cooling technologies for any new or significantly modified power generation facilities and an alternatives analysis to continue the consideration of water conservation technologies in an industry that is the largest consumptive user of water in the basin.

1 Federal Register/Volume, 89, Number, 56/Thursday, March 21, 2024/Proposed Rules.

Mr. Epstein and TMI-Alert have clearly defined interests relating to the Susquehanna River. TMIA has actively participated in policy, rule-making, and testimony before the Commission for over 15 years. (2)

Three Mile Island-Alert, Incorporated is a safe-energy organization based in Harrisburg, Pennsylvania that was founded in 1977, and has members throughout central and eastern Pennsylvania. TMIA monitors Peach Bottom, Susquehanna, and Three Mile Island nuclear generating stations. TMIA is the largest and oldest safe-energy group in central Pennsylvania.

TMIA enjoys widespread public and political support in its role as a watchdog of nuclear power production. In the spring of 1987 TMIA was recognized by the Pennsylvania House of Representatives for 10 years of community service. The House, along with the City of Harrisburg, formally applauded TMIA's efforts on behalf of the community at their 20th and 25th anniversaries.

Mr. Epstein has served as either Spokesperson or Chairman of the organization since 1984. Three Mile Island Alert membership has suffered through the 1979 meltdown at Three Mile Island, the forced shutdown of Peach Bottom in 1987, and rate shock caused by the construction of the Susquehanna Steam Electric Station in the 1980s.

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2 Re: "Amazon and Talen Energy," (July 13, 2024.)

Re: "Ownership Data for Water Utilities," (November 2, 2023.)

Re: "Project Sponsor: Constellation Energy Generation, LLC. Project Facility: Three Mile Island Generating Station, Londonderry Township, Dauphin County, Pa. Applications for renewal of groundwater withdrawals approvals based on changes in operating status of the project and revised demand projections," (November 3, 2022.)

Re: Technical Review: Susquehanna River Basin Commission Docket Numbers: Three Mile Island Nuclear Station, Unit 1 - Well A - 2021-054; Three Mile Island Nuclear Station, Unit 1 - Well B - 2021-055; and, Three Mile Island Nuclear Station, Unit 1 - Well C - 2021-056," (January 3, 2022.)

Re: Three Mile Island Station, Unit 1, SRBC Pending Nos. 2021-054, 2021-055, & 2021-056,2022.

Re: Three Mile Island, Clean Water Act ("CWA"), Section 401, Water Quality Certification, (February 10, 2021).

Re: "York Haven Hydroelectric Project, (FERC Project Number, 1888) Testimony of Eric J. Epstein for TMI-Alert, February 6, 2020.

Re: Three Mile Island Alert, Inc.'s Comments on the Susquehanna River Basin Commission's Draft Comprehensive Plan for the Water Resources of the Susquehanna River Basin, August 18, 2008.

Re: Eric Joseph Epstein's Administrative Appeal of the Susquehanna River Basin Commission's Approval of the Final Determination of PPL Susquehanna, LLC's Application for Surface Water Withdrawal Request to Modify Application 19950301-EPU-0572 Pursuant to 18 CFR §808.2, (September 15, 2008.)

TMI-Alert has actively intervened and monitored the licensing and operation of the Peach Bottom Atomic Power Station ("Peach Bottom") since 1984, the Susquehanna Steam Electric Station ("SSES" or "Susquehanna") since 1984, and Three Mile Island Nuclear Generating ("TMI") since 1977.

TMIA's membership has legitimate and historic concerns regarding radiological contamination resulting from radiological releases related to normal and abnormal operations that both impact the value of their property, and interfere with the organization's rightful ability to conduct operations in an uninterrupted and undisturbed manner.

Mr. Epstein's participation may reasonably be expected to assist in developing a sound record. Epstein is well versed and an acknowledged nuclear expert, "...On careful review of the pleadings, we acknowledge Epstein's expertise in the areas of nuclear decommissioning, nuclear waste isolation, nuclear economics, nuclear safety, universal service, and community investment." (3)

Mr. Epstein's advocacy and his responsibility to TMIA's membership are undisputed and have been unbroken. TMIA has numerous members that reside in close proximity to the three nuclear generating stations in the Susquehanna River Valley. These members have concrete and particularized interests that will be directly affected positively by this rule change. Moreover, the Pennsylvania Constitution is clear in Article I, Natural Resources and the Public Estate Section 27, which protects all Pennsylvanians.

> The people have a right to clean air, pure water, and to the preservation of the natural, scenic, historic and esthetic values of the environment. Pennsylvania's public natural resources are the common property of all the people, including generations yet to come. As trustee of these resources, the Commonwealth shall conserve and maintain them for the benefit of all the people. (Joint Resolution, Number 3, Section 27.)

TMIA's history and mission are germane and important to this proceeding. As demonstrated by the above discussion and attached supporting materials, Three Mile Island Alert members are clearly impacted by this proposal. The SRBC's proposal is timely given the challenges of climate change, drought and water quality. Water conservation and quality, and the equitable distribution of water resource are germane to TMIA's stated mission.

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3 PP&L Base Rate Proceeding, 1995, PA PUC Commission, Administrative Law Judge Robert Christianson, Re: Epstein Protest, Paragraph, 10.

III. Background: Nuclear Power's Adverse Impact on the Susquehanna River.

In a boiling water reactor ("BWR") the primary water system absorbs enough heat from the fission process to boil its water. In contrast to the pressurized water reactor, the BWR uses only two separate water systems as it has no separate steam generator system. This steam and water mixture rises to the top of the reactor and passes through two stages of moisture separation. Water droplets are then removed and steam is allowed to enter the steam line. The steam is directed to the turbine. The turbine begins to turn within the generator and electricity is produced.

The Peach Bottom Atomic Power Station and the Susquehanna Steam Electric Station are boiling water reactors.

In a pressurized water reactor ("PWR"), nuclear fission produces heat inside the reactor. That heat is transferred to water circulating around the uranium fuel in the first of three separate water systems. The water is heated to extremely high temperatures, but doesn't boil because the water is under pressure. The water within the primary system passes over the reactor core to act as a moderator and coolant but does not flow to the turbine. It is contained in a pressurized piping loop. The hot, pressurized water passes through a series of tubes inside the steam generator.

The Three Mile Island Nuclear Generating reactor is a pressurized water reactor.

Nuclear power generation has a measurable negative impact on the Susquehanna River every day. The environmental hazards include: cooling tower blow down, effluent discharges, fish kills, thermal inversion, and water consumption. Nuclear plants use millions of gallons of water daily for cooling and to perform normal industrial applications. There are three nuclear power facilities on the Susquehanna River. There are four operating boiling water nuclear generation units. Two plants, with three units, are located on the Lower Susquehanna, and have the capacity to draw in as much as half the flow of the Susquehanna River in a day.

Water use and water consumption have direct and indirect relationships with nuclear power's safety related components, plant cooling; and, are connected to the health and safety of the Susquehanna River and the regional community. NRC technical specifications are reactor-specific, and include a limit on water intake temperatures.

Nuclear licensees have not addressed the impact of nuclear power generation on aquatic ecosystems, corrosion, entrainment, impingement, groundwater contamination, tritium migration or water consumption and disposal. Licensees had the opportunity during the relicensing of Peach Bottom, Susquehanna, and Three Mile Island to address aquatic and water issues. The relicensing processes did not require a revised Environmental Impact Statement and all three licensees entered outdated and generic information. The reactors were exempted from considering the impact of climate change on the operation of aging plants. The NRC allowed the licensees to grandfather (4) data that ignored climate change, new environmental regulations, and the impacts of aging. The NRC's relicensing process failed to compel Peach Bottom, the Susquehanna Electric Steam Station, and Three Mile Island from addressing numerous issues that could adversely impact the areas surrounding the plant, i.e., climate change, earthquakes, and severe flooding.

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4 The Nuclear Regulatory Commission Notice Renewing Nuclear Power Plant Licenses," Environmental Review, 88 Fed. Reg. 13,329 (March 3, 2023), Generic Environmental Impact Statement for License Renewal of Nuclear Plants."

The Department of Environmental Protection and the Nuclear Regulatory Commission exempted Peach Bottom Atomic Power Station from preparing a final Environmental Impact Statement. (Please refer to the legal ruling ordering Peach Bottom to conduct an updated Environmental Impact Statement under III. C.) Neither Constellation nor the NRC will explain why Peach Bottom is not conducting a site-specific Environmental Impact Statement for grandfathered environmental approvals after the NRC Order. (NRC, Region 1, Annual Assessment, May 24, 2024.)

The original Environmental the Impact Statements ("EIS') were conducted in early 1970s by the NRC's predecessor agency - the Atomic Energy Commission ("AEC") for Peach Bottom and Three Mile Island. Susquehanna's EIS was completed in the early 1980s by the Nuclear Regulatory commission. All of the licenses were granted approval prior to the Commonwealth of Pennsylvania enactment of aggressive statutes and regulations. Among the legislation passed were the Radiation Act (1984), Chesapeake Bay Commission Agreement Act (1985), Hazardous Site Cleanup Act (1988), Pennsylvania Environmental Stewardship and Water Protection Act (1999) and Act 129 (2008).

The initial EIS for all of the nuclear power plants on the Susquehanna River were issued decades prior to the emergence of the Environmental Protection Agency ("EPA") Section 316(b) of the Clean Water Act. EPA issued regulations on the design and operation of intake structures in order to minimize adverse environmental impacts. The EPA promulgated regulations in 2001, 2003, 2006 and 2014. The requirements are included in the National Pollutant Discharge Elimination System ("NPDES") permit regulations, 40 CFR Parts 122 and 125 (Subparts I, J, and N).

The AEC was abolished by the Energy Reorganization Act of 1974, which assigned its functions to two new agencies: the Energy Research and Development Administration and the Nuclear Regulatory Commission. This year the NRC was reconstituted under the Advance Act. The makeover "purports to preserve the Nuclear Regulatory Commission's existing mission of protecting public health, safety and the environment, the act contradicts that mission by mandating the NRC to promote nuclear energy and to "fast track" nuclear licensing regulations. This double mission of protection and promotion is paradoxical and illogical. This conflict is why, in 1974 the U.S. dissolved the Atomic Energy Commission and created the NRC as an independent agency to regulate commercial nuclear power, with oversight of public health, safety and the environment. Nuclear promotion and advancement was delegated to the Department of Energy. These conflicting missions were unacceptable in 1974 and are still unacceptable today." (5)

The Nuclear Regulatory Commission has made a coordinated effort to ignore the air, land, and water impacts of nuclear power production. This retreat from safety was captured in last month's passage of the Advance Act ward impact of nuclear. Edwin Lyman, nuclear power safety director of the Union of Concerned Scientists stated: "Make no mistake. This is not about making the reactor licensing process more efficient, but about weakening safety and security oversight across the board, a longstanding industry goal. The change to the NRC's mission effectively directs the agency to enforce only the bare minimum level of regulation at every facility it oversees across the United States." (6)

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5 Counterpunch, "The ADVANCE Act: A Bipartisan Surrender to the Nuclear Lobby," by Mays T. Smithwick and Jacqui Drechsler, Jul 26, 2024.

6 Statement by Edwin Lyman, Nuclear Power Safety Director, Union of Concerned Scientists, Published on June 17, 2024

The Susquehanna River Basin Commission had been at the forefront of environmental stewardship. The SRBC identified climate change and water use management in 2008.

> The [SRBC] Committee has identified finalizing accurate water supply and demand projections to improve the capability to plan for the social, economic, environmental and recreational needs of the Lower Susquehanna region as a leading priority. This information serves as the basis for identifying and analyzing Critical Water Planning Areas, and for better preparation in advance of extreme flood and drought conditions. Collection and dissemination of sound water budget data is a broad goal shared by other regions of the state, but it is especially important for this region because some well-known critical water needs and unique regional features influence how water resource plans in the region are designed and implemented. (7)

Climate change, drought and flooding were anticipated over 20 years ago by the Susquehanna River Basin Commission. At that time TMIA argued: "We do not take issue with the Committee's identified priorities, we only ask that you expand your priorities to include the two nuclear power plants on the Lower Susquehanna River - Peach Bottom and Three Mile Island. These three units have been uprated and are likely to have license extensions for another two decades." (8)

However, the Nuclear Energy Institute and the Nuclear Regulatory Commission continue to resist examining the threat of climate change to nuclear generating stations. On April 2, 2024, the US Government Accountability Office ("GAO") publicly released an extensive report, "Nuclear Power Plants Should Take Actions to Fully Consider the Potential Effects of Climate Change" (GAO-24-106326. The report thoroughly examined how climate change is expected to adversely affect nuclear power plants, and what actions the Nuclear Regulatory Commission has taken to address the risks to nuclear power plants. The GAO conducted extensive interviews with officials from the Department of Energy, the National Oceanic and Atmospheric Administration, and the Nuclear Regulatory Commissions. The GAO recommend that the NRC needed to do more than look at the reactor operation impacts on climate change: NRC needs to begin analyzing the adverse impacts climate change has on nuclear power plant operations.

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7 The Lower Susquehanna Regional Resources Committee, Draft Priorities, May 18, 2008.

8 "Three Mile Island Alert, Inc.'s Comments on the Water Resources Planning Act Lower Susquehanna Regional Resources Committee Meeting," Public Meeting, and Hearing, September 15, 2008.

A. Groundwater Leaks at Nuclear Reactors.

Unmonitored leaks of radioactive materials offsite are violations of NRC regulations. Leaks of radioactive contaminated liquid into the ground from buried components at American nuclear reactors have occurred with increased frequency. Many of these leaks were initially undetected and remained undetected for many years. In at least one case, the leak was not detected until after an underground plume of several million gallons of contaminated water traveled beyond the nuclear facility's site into drinking wells. In most cases, the leak was finally detected more by happenstance than by rigorous monitoring. In all cases, a small leak undetected for an extended period of time permitted large amounts of contaminated water to enter the ground around the facilities.

A list of tritium leaks compiled in 2006 include: Arizona: Palo Verde; Connecticut: Connecticut Yankee and Haddam Neck; Delaware: Salem; Georgia: Hatch; Kansas: Wolf Creek; Illinois: Braidwood, Byron, and Dresden; Massachusetts: Pilgrim and Rowe; Missouri: Callaway; New Hampshire: Seabrook; New Jersey: Oyster Creek; New York: Indian Point; Ohio: Perry; Pennsylvania: Peach Bottom and Three Mile Island; Tennessee: Watts Bar; Vermont: Vermont Yankee; and Wisconsin: Point Beach. Most nuclear facilities experience leakages of contaminated water. It seems entirely possible, if not highly likely, that more nuclear facilities have an ongoing leak that has yet to be detected. (9)

Barack Obama was a senator from Illinois at the time tritium leaked, and emerged as a public health and safety issue. He stated that, "(w)hile it's encouraging that the nuclear industry recognizes it has a special responsibility to keep communities informed of tritium leaks, the voluntary guidelines recommended by the Nuclear Energy Institute would still allow tritium leaks to occur without the public ever finding out about it," he said. "The nuclear industry already has a voluntary policy, and it hasn't worked." (10)

Three Mile Island-1 found elevated tritium levels onsite during the fall of 2005. (11) The Elevated levels were due toa leak at one well traced to a sump from an auxiliary boiler in the turbine building (East Side). TMI's data, which was reviewed by the DEP, found tritium levels to be about 19,000 pCi/liter. The contaminated water did not commingle with onsite groundwater or broach the site boundary. TMI had announced that they may drill two additional wells. (12)

The Nuclear Regulatory Commission apologized for public reassurances from its staff that a major leak of radioactive tritium from Xcel Energy's Monticello nuclear reactor had not reached the Mississippi River, drinking water source for 20 million people including the Minneapolis/St. Paul metro area.

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9 "Tritium leaks a problem at many nuclear plants, "Burlington Free Press," Sam Hemingway, January 10, 2010.

10 Hal Dardick, "Obama Still to Press Spill Bill Despite Nuclear Industry Plan," "Chicago Tribune," May 10, 2006.

11 The EPA tritium limit for safe drinking water is 20,000 picocuries per liter.

12 David Beaulieu, NRC Senior Resident Inspector, October 25, 1990.

13 NRC Senior Environmental Project Manager Stephen S. Koenick, May 15, 2024.

B. Pipe failures. (14)

Pipes at nuclear power plants carry cooling water to the reactor vessel and spent fuel pool, transport steam to the main turbine, provide hydrogen gas to cool the main generators, supply fuel and lubricating oil to the emergency diesel generators, maintain the fire sprinklers ready to extinguish fires, and numerous other vital functions. Given so many pipes, a success rate of 99.99%—remarkably similar to a failure rate of one broken pipe out of ten thousand pipes—would result in lots of piping failures.

The Electric Power Research Institute's report revealed lots of piping failures at U.S. nuclear power plants between 1961 and 1997 (Figure, 1). The non-leaking failures are identified by inspections indicating that safety margins had been compromised, forcing the pipes to be replaced before they leak. The leaking failures are identified by puddles on the floor or other obvious signs, again forcing pipes to be replaced.

Type of Failure	Number of Events
Total Non-Leaking Failures	**1816**
IGSCC	1330
Wall Thinning	483
Delamination	2
Too Thin	1
Total Leaking Failures	**2247**
Small Leak	1999
Large Leak (Failed)	65
Rupture/Severed*	179
Separation	4
TOTAL	**4064****

* Includes 1 event that was classified as puncture failure

** Includes 1 event where the type of failure was not given

Figure, 1 (Source: Electrical Power Research Institute.)

14 Union of Concerned Scientists, "Nuclear Pipe Nightmare," Dave Lochbaum, (October 27, 2015.)

The Electric Power Research Institute's report identified numerous reasons why pipes break

(Figure, 2). MIC under corrosion stands for microbiologically induced corrosion—tiny little bugs that eat metal. Pipes can be designed wrong, installed wrong, or weakened via an array of methods during installation.

Failure Mechanism Categories	
Category Title **Level 1 Mechanism** **Level 2 Mechanism** **Level 3 Mechanism**	**Category Title** **Level 1 Mechanism** **Level 2 Mechanism** **Level 3 Mechanism**
Aging 1. Aging	**Erosion, Flow-Assisted Corrosion** 1. Erosion, Flow-Assisted Corrosion 2. Cavitation 2. Single Phase Erosion-Corrosion 2. Slurry Erosion 2. Wet Steam Erosion
Corrosion 1. Corrosion 2. Acid Corrosion 2. Galvanic Corrosion 2. MIC 3. Dealloying 2. Pitting Corrosion 2. Saltwater Corrosion	**Fatigue** 1. Fatigue 2. Corrosion Fatigue 2. Thermal Fatigue 2. Vibratory Fatigue
Construction/Fabrication Defect/Error 1. Construction/Fabrication Defect/Error 2. Damage 3. Lamination 3. Wrong Material 2. Error 3. Installation Error 2. Weld Defect 3. Lack of Fusion 3. Porosity 3. Slag 3. Slag/Porosity	**Stress Corrosion** 1. Stress Corrosion 2. Chloride Stress Corrosion 3. IGSCC 3. TGSCC
Design Error 1. Design Error 2. Dynamic Load 2. Improper Support 2. Material Weakness	**Mechanical Damage** 1. Mechanical Damage 2. Fracture 3. Frozen Line 2. Deformation
	Wear 1. Wear 2. Corrosion Wear
	Water Hammer 1. Water Hammer
	Not Specified 1. Not Specified

C: Peach Bottom Atomic Power Station's Environmental Impacts on the Susquehanna River Basin.

Peach Bottom does not use a closed-cooling system. The Peach Bottom Atomic Power Station uses and treats potable water from the Susquehanna River. The average daily usage is anywhere from 280,000 to 360,000 gallons per day.

The station does not currently use evaporative cooling towers for cooling needs, but evaporates up to 28 million gallons daily ("mgd") through heat transfer via once-through cooling with water withdrawn from Conowingo Pond. The Peach Bottom Atomic Power Station, located on the west bank of the Conowingo Pond in York County, Pennsylvania, and 36 miles from downtown Baltimore- is a two-unit nuclear generating facility that uses water from the Conowingo Pond for cooling purposes.

Water shortages on the Lower Susquehanna reached critical levels in the summer of 2002. For the month of August 2002, 66 of 67 Pennsylvania counties had below normal precipitation On August 9th, 2002, Governor Schweiker extended the drought emergency for 14 counties across Southcentral and Southeast Pennsylvania. Precipitation deficits at or exceeding 10.0 inches were recorded in several counties, included Dauphin County. The greatest deficit of 14.6 inches was in Lancaster County. Peach Bottom is located in Lancaster and York Counties while Three Mile Island is situated in Dauphin and Lancaster Counties. (Pennsylvania Department of Environmental Protection, "Drought Report and Drought Conditions Summary," August to September, 2002.)

Ten years later in April 2012, the Susquehanna River reached record seasonal lows matching drought conditions of 1910 and 1946. U.S. Geological Survey analysis showed stream flows at hydrological emergency levels in 42 of the state's 67 counties. Another 10 counties were at warning levels, and another 12 at watch level. Only three were normal or above. Groundwater levels are at emergency levels in 13 counties. The SRBC began issuing temporary orders to cease water withdrawals in February, 2012.

The Lower Susquehanna River is impacted by abnormal weather conditions. For example, "periods of drought or extended periods of low flow can adversely affect the ability of the dam to meet minimum flow and summertime pond level minimums. In addition, due to high ambient water temperatures and low flow, maintaining the minimum dissolved oxygen requirement is also challenging. These situations can further be compounded if the flows coming into the pond as measured at the Marietta gage do not equal the flow outfalls. This not only affects the dam, but also the water supply companies and Peach Bottom Atomic Power Station due to the loss of pond level. Additionally, recreational boating and marina operation becomes severely hampered due to low water levels. ("Conowingo Pond Management Plan," Publication Number,242, June 2006, p. 71.)

The Susquehanna River Basin is flood prone. "Since record-keeping began 200 years ago, the Susquehanna River has proven one of the most flood-prone watersheds in the nation. The watershed encompasses 27,510 square miles and extends from New York to Pennsylvania to the Chesapeake Bay in Maryland – where nearly 4 million people live...Of the 1,400 communities in the river basin, 1,160 have residents who live in flood-prone areas." ("7th Annual Susquehanna River Symposium," Bucknell University, October 12-13, 2012.)

Unlike other consumptive users in the summer of 2002, Peach Bottom, did not "conserve" water until the plant was forced to close to address a massive fish kill. On August 30, 2002, high differential pressures on the circulating water intake screens forced the manual shut down of Peach Bottom. "The problem was caused by a sudden surge in the amount of fish (Gizzard Shad) that entered the intake canal and clogged the screens. Unit 3 power was returned to 100 percent following cleaning of the circulating water screens and restating of the 3" A' circulating water pump." (Nuclear Regulatory Commission, IR-50-277/02-05; 50-278/02- 05).

Five years later in the summer of 2007, Peach Bottom was detected returning water to the Susquehanna River at temperatures in excess of 110 degrees. Communities and ecosystems that depend on limited water resources are adversely affected by "normal operating conditions" at nuclear stations.

The Conowingo Pond also plays a critical role in Peach Bottom's water intake. "Declining pond levels threaten Peach Bottom's cooling water intake, recreational use of the Conowingo pond, shore habitat levels, and downstream flows. As drought conditions continue, the operators continue to generate hydroelectricity as much as possible using the water available to them, but it becomes a secondary concern. The primary concern becomes the depletion of storage in the pond and safeguarding the ability of the pond to continue to make adequate releases during low flow events of extended duration."

> The Conowingo pond provides a mixed warm water recreational fishery for large mouth and small mouth bass, channel catfish, white crappie, bluegill, and to lesser degrees, striped bass, walleye and carp. The most abundant fish in the Conowingo pond is the gizzard shad. Bass fishing tournaments are commonplace during the open season. Steep, wooded slopes and railroad postings limit shoreline and boat access. The heated effluent from Peach Bottom Atomic Power Station attracts game fish during the winter and extends the open-water fishing season. (15)

Fish kills have become an acceptable part of nuclear generation at Peach Bottom

> Millions of fish (game and consumable), fish eggs, shellfish and other organisms are sucked out of the Lower Susquehanna River and killed by nuclear power plants annually. It is hard to know just what the impact on fisheries is, because cool water intakes have been under the radar screen compared to some types of pollution, said Pennsylvania Fish and Boat Commission aquatics resources chief Leroy Young." (Ad Crable, "Intelligencer Journal," January 15, 2005).

A former Peach Bottom nuclear plant employee said he was "sickened" by the large numbers of sport fish he saw sucked out of the Susquehanna. "When the water comes in, fish would swim in through tunnels and swim into wire baskets," said a man who lives in southern Lancaster County and who asked that his name not be used. "There were hundreds and hundreds of fish killed each day. Stripers and bass and walleye and gizzard shad and all kinds of fish. It took a forklift to carry them out," (Intelligencer Journal, January 15, 2005).

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15 Conowingo Pond Management Plan," Publication Number, 242 June 2006 p. 21.)

Peach Bottom's request to extend the operating licenses for Peach Bottom hit a wall at the Nuclear Regulatory Commission. The NRC ruled that Constellation would have to conduct a revised environmental study. Subsequent License Renewal applications will not be able to rely on the 2013 Generic Environmental Impact Statement. Applicants will be able to rely on the updated GEIS that is in development once it is finalized. In other words, there will not be a site-specific Environmental Impact Statement to license Peach Bottom for an additional 80 years.

> In considering the pending motions of Beyond Nuclear, Inc. for leave to file a new contention and to reopen the record, we have the opportunity to reconsider the Commission's decision in CLI-20-11, which applied the reasoning in CLI-20-03 in the Turkey Point proceeding to this case. Today, we reversed CLI-20-03-, which held that C.F.R. § 51.53.(c)(3) applied to a subsequent license renewal applicant's preparation of an environmental report, and now reverse the portion of CLI-20-11 related to Contention A, in which Beyond Nuclear claimed that the environmental report failed to address accident risks posed by aging reactor equipment during a second license renewal term.
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> In today's related decision in the *Turkey Point* proceeding, CLI 22-04, we held that 10 C.F.R. § 5153(c)(3) only applies to an initial license renewal applicant's preparation of an environmental report and that the Generic Environmental Impact Statement for License Renewal of Nuclear Plants did not address subsequent license renewal. For the reasons explained in CLI--, we conclude that the Staff did not conduct an adequate NEPA analysis before issuing Exelon licenses for the subsequent license renewal period for Peach Bottom. As we have motions pending before us and the proceeding remains open, we can modify, suspend, or revoke Exelon's licenses, as appropriate. (16)

Neither Constellation nor the NRC will explain why Peach Bottom is not conducting a site-specific Environmental Impact Statement for grandfathered environmental approvals. (17) (NRC, Region 1, Annual Assessment, May 24, 2024.)

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16 The Unites States Nuclear Regulatory Commission, In the Matter of Exelon Generation Company, LLC, Peach Bottom Atomic Power Station, Units and 50-277, Docket Nos. SLR 50-277-SLR, 50-278-SLR, Memorandum and Order, (February 24, 2022.)

Please refer to Exhibit, #1. Beyond Nuclear, Inc.'s Motion for Leave to File New Contention Based on Draft Supplement to Generic Environmental Impact Statement for Subsequent License Renewal of Peach Bottom Operating License (September 3, 2019); corrected September 5 ,2019); Beyond Nuclear, Inc.'s Motion to Reopen the Record For Purposes of Considering and Admitting a New Contention Based on Draft Supplement to Generic Environmental Impact Statement For Subsequent License Renewal of Peach Bottom Operating License and Request For Consideration of Some Elements of the Motion Out of Time (September 23, 2009); CLI-20-11, 92 NRC 335(2020); Florida Power & Light Co. (Turkey Point Nuclear Generating Units and), CLI-20-03, 91 NRC 133 (2020).

The Nuclear Regulatory Commission Notice Renewing Nuclear Power Plant Licenses, Environmental Review, 88 Fed. Reg. 13,329 (March 3, 2023), Generic Environmental Impact Statement for License Renewal of Nuclear Plants."

D: The Susquehanna Electric Steam Station's Environmental Impact on the Susquehanna River Basin.

The magnitude of water used at nuclear power plants is readily evidenced at the Susquehanna. Steam Electric Station, is a two-unit nuclear power plant located on the Susquehanna. Every day the SSES loses 14.93 million gallons of water as evaporative cooling tower water vapor from each of its two units. Each day 11 million gallons of contaminated cooling tower basin blowdown water is returned to the Susquehanna River.

All hyperbolic or forced-air cooling towers also create dirty water called blow down water that is returned back to the river with contaminants concentrated within it. Make-up water is also used to replace blow down water." "The dirty water released from the cooling towers back into the Susquehanna River as blow down will be approximately 25% of the amount of water that is withdrawn. For every four gallons the plant withdraws, it sends back one gallon of blow down." The blow down is a pollutant for three reasons:

> Three out of every four gallons of withdrawn evaporate water (consumptive use water) that will be initially drawn from the Susquehanna River will be returned to the river as blow down with four times more concentration of pollutants and minerals than when that water was withdrawn. In addition to concentrating contaminants and minerals that already existed in the river, the blow down contains biocides and algaecides used within the cooling towers to prevent them from becoming clogged with mold and mildew. Along with chemical contamination and highly concentrated minerals, the dirty blowdown water will be approximately 20 degrees hotter than the river water to which it is being returned. (17)

The SSES takes an average of 29.86 million gallons of water per day from the Susquehanna River that is not returned. The Extended Power Uprate doubled the amount of water that was needed with an upper limit of 65.4 million gallons per day, totaling almost 24 billion gallons of Susquehanna River Water per year.

> ...will withdraw an average of 60.9 gallons per day (mgd) (230 million L/d) of water from the Susquehanna River for cooling tower evaporative losses and other plant needs, with a maximum daily water withdraw estimate of 65.4 mgd (248 million L/d). This represents a 4.5 and 12.2 percent increase, respectively, in intake water withdrawn from the Susquehanna River from the pre-EPU conditions (NRC 2007a). Some of this water would be returned to the river as cooling tower blowdown, with the difference equaling the amount of the consumptive water use by SSES. Consumptive water use due to evaporation and drift of cooling water through the SSES cooling towers is expected to increase from 38 mgd (144 million L/d) to 44 mgd (166 million L/d). Based on the Susquehanna River's annual mean flow rate, an average annual loss of 0.5 percent of river water at the SSES location would result. During low-flow conditions, which usually occur in late August, the average evaporative loss at SSES could approach 1 percent of the river flow (PPL 2006b). (18)

17 Expert Witness Report of Arnold Gundersen, Re: Bell Bend Nuclear Power Plant Application for Groundwater Withdrawal Application for Consumptive Use, BNP-2009-073, Susquehanna River Basin Commission, January 5, 2010.

18 US NRC, Environmental Impacts of Operation, Draft NUREG-1437, Supplement 35, 4-15, April 2008.

E: The Three Mile Island Nuclear Generating Station's Environmental Impact on the Susquehanna River Basin.

Please refer to Exhibit, #2: Technical Review: Susquehanna River Basin Commission Docket Numbers: Three Mile Island Nuclear Station, Unit 1 - Well A - 2021-054; Three Mile Island Nuclear Station, Unit 1 - Well B - 2021-055; and, Three Mile Island Nuclear Station, Unit 1 - Well C - 2021-056. (January 3, 2022.)

IV. Consumptive Use and Nuclear Power.

There have been several reports completed raising concerns about consumptive use on the Susquehanna River Consumptive Use Mitigation Plan – SRBC, 2008, Ecosystem Flow Recommendations for the Susquehanna River Basin – The Nature Conservancy 2010, and the draft Susquehanna River Management Plan – PA Fish and Boat Commission 2011. All three reports include sections on consumptive use. All three reports make statements that the existing requirement for the mitigation of the Q7-10 flow rates are not adequate to protect the ecosystems of the Susquehanna River. The following paragraphs from the Susquehanna River Management Plan draft best express the concerns about the future consumptive use increases in the Susquehanna River Basin:

> A potentially significant threat to aquatic communities in the Susquehanna River Basin is increased consumptive use (CU) of water to meet expanding societal demands for water. CU is defined by SRBC as water that is used in a way it is not returned to the basin, including through evaporation, irrigation, use in products and diversions out of the Susquehanna watershed. Consumptive water use regulation, adopted by the SRBC in 1976 and most recently updated in November 2010, requires project sponsors to provide mitigation, either through providing compensatory water or fees, for their water use during low flow events. The maximum current use potential in the basin is estimated to be 882.5 million gallons per day (mgd) and is projected to increase to 1,202.2 mgd by 2025 of which, mitigation is required for 116.7 mgd and 390.3 mgd, respectively. Historically, actual usage falls somewhat below the actual permitted usage, but management based on permitted values allows for more conservative estimates for resource protection. (19)

Three years later the Pennsylvania Fish and Boat Commission Bureau of Fisheries published a report and concluded:

> The most recent CU mitigation plan has recognized the need for revised mitigation thresholds from the historic Q7-10 threshold to be more responsive to demonstrated aquatic and riparian resource needs, potentially including recently observed disease-related mortality of smallmouth bass and largemouth bass in the Susquehanna River and major tributaries. The 2008 Plan quantifies the need to secure more storage to achieve mitigation flows at the permitted levels, and the SRBC is currently working with partners to develop and acquire innovative storage options in order to set more protective/responsive CU mitigation goals. (20)

The lower Susquehanna River is one of the most vulnerable sections of the river during low flows. Release of the mitigation flows upstream of the consumptive use does provide enhanced stream flows upstream of the consumptive use, but any analysis of mitigation (pooled or otherwise) should also include documentation that during drought conditions a release from an upstream asset provides the total mitigation assumed at the point of consumption.

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19 The Susquehanna River Basin Commission, The Draft Susquehanna River Management Plan, (2008).

20 Pennsylvania Fish and Boat Commission, "The Susquehanna River Management Plan, A Management Plan Focusing on the Large River Habitats of the West Branch Susquehanna and Susquehanna Rivers of Pennsylvania, p. 38, (2011).

There is no doubt that a cooperative pooled asset program for consumptive use mitigation is an invaluable tool. However, there are limits, which makes it essential to implement dry cooling in the Susquehanna River Basin without exemptions for data centers or gas and nuclear power generating stations

Regional water coordination was clearly recognized by the Department of Environmental Protection ("DEP") on June 16, 2007 when the DEP advertised that the Susquehanna River Basin Commission was proposing comprehensive revisions to its regulations governing water withdrawal and consumptive use projects. (Proposed Rules [Federal Register: October 1, 2007 (Volume 72, Number 189) [Page 55711-55712] PART 808.)

Federal and statewide statues cannot be unilaterally exempted or ignored by Constellation, Talen Energy or TMI-2 Solutions. The Nuclear Regulatory Commission as no authority to deal with water use consumption and withdrawal. NRC technical specifications are reactor-specific, but all include a limit on water intake temperature.

The regional changes include a reduction in the duration of consumptive use and withdrawal approvals from 25 years to 15, ending the recognition of "pre-compact" or "grandfathered" consumptive uses or withdrawals upon a change of ownership, no longer allowing the transfer of project approvals when a change of ownership occurs; along with a requirement that sponsors of consumptive use projects involving ground or surface water withdrawals request approvals for the consumptive use and the withdrawals. The SRBC stated,

> If additional releases are made from new or existing sources, they will need to be accounted in the monitoring data at the Marietta gage. It will be important to understand how operations of Conowingo Dam will be affected and how existing CU [Consumptive Use] mitigation agreements for Peach Bottom Atomic Power Station and the City of Baltimore could be impacted. Operations of Conowingo Dam are driven by flows at Marietta, as are existing mitigation agreements for the Peach Bottom Atomic Power Station and the City of Baltimore. It will be necessary to specify that those agreements remain in force despite upstream mitigation, and to resolve methodologies for implementing the agreements in instances when upstream mitigation releases are distorting the flow measurements at Marietta. Regardless, Exelon and Baltimore will still be required to mitigate the CU of their projects. (21)

The SRBC Plan also acknowledges that the existing Q7-10 flow requirements do not protect the stream/river ecosystems nor do they provide FREC flows to the Conowingo pond in times of low flow. The SRBC Plan also states that final mitigation strategy is likely to incorporate aspects of both local and basin wide implementation.

It is timely and vitally critical that the Susquehanna River Basin Commission enacts polices that help manage consumptive use. The rule proposal making dry cooling a priority is absolutely necessary. "Project sponsors proposing new or significantly modified power generation plants in the basin shall consider the use of dry cooling technologies and submit to the Commission a rigorous alternatives analysis."

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21 "Consumptive Use Mitigation Plan," Publication Number, 253, March 2008, p. 29.

V. Dry Cooling and Nuclear Power.

The nuclear power industry has been studying dry cooling dating back to 1974. The difference today is that the issue of economics has been eliminated as a factor. "The Inflation Reduction Act created a production tax credit (Internal Revenue Code (IRC) section 45U) for existing nuclear plants, giving them more economic security to keep operating." (22) It is time to deploy dry cooling as a climate change tool, and an indispensable resource to manage consumptive water use. This policy will only be effective if data centers, gas facilities and nuclear generating stations are not exempted. The next step is implementation of the Changes to Proposed to Part 81 § 801.12 Electric power generation.

The Energy Research and Development Administration commissioned dry-cooling feasibility study with Catalytic Incorporated. Study of Dry-Type Cooling Towers and Their Application to Large Nuclear Power Plants," Catalytic, Incorporated Charlotte, North Carolina, 1974.

> As the requirement for more power plants grows, the number of available water-rich sites continues to decline. Construction of new power plants is steadily using up a portion of the available water-rich sites, and environmental legislation is further reducing the use of available water-rich sites. The power industry is facing a serious problem that can only be solved by the re-use of available cooling water or by the use of dry-type cooling systems.
>
> In water-short areas, wet cooling becomes a problem because of the quantity of make-up water required. Dry-type cooling systems can be used in solving this type of problem and will possibly be used more as water becomes scarce. (23)
>
> An "Assessment of Requirements for Dry Towers" was commissioned by the Energy Development and Research Administration. Hanford Engineering Laboratory studied and made an insightful prediction for the Mid-Atlantic Region.
>
> > Fresh water streamflow is generally inadequate in this region under low flow conditions to satisfy the consumptive requirements of projected growth of steam electric plants coupled to wet towers. Essentially no capacity remains in the Delaware and Potomac Rivers. Water supplies are physically available in the Susquehanna for further development; however, there have been indications from regulatory bodies that additional consumptive use of water from the river may be prohibited. (24)

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22 "Fact Sheet: Biden-Harris Administration Announces New Steps to Bolster Domestic Nuclear Industry and Advance America's Clean Energy Future," The White House," May 2024.

23 "Dry-Type Cooling Towers and Their Application to Large Nuclear Power Plants," Energy Research and Development Administration, Catalytic, Incorporated Charlotte, North Carolina, 1974.

24 "Assessment of Requirements for Dry Towers," Energy Development and Research Administration," D. E. Peterson and J.C. Sonnichsen, Hanford Engineering Laboratory. September, 1976.

In 1979 dry cooling was considered as a cooling option at Indian Point-3. The Final Environmental Statement ("FES") was also looking at cooling options at a nuclear plant due to the potential impact of brackish water.

This FES presents an evaluation and analysis of several closed cycle cooling systems from an economic and environmental standpoint: cooling ponds and lakes; spray ponds and spray canals; dry cooling towers and wet-dry mechanical draft cooling towers and wet cooling towers. Major factors entering into selection of tower type were noise, drift, and aesthetics. (24)

Argonne National Lab announced it was exploring dry cooling for nuclear reactors, "because climate change threatens to disrupt the traditional method of cooling reactors, which relies on nearby bodies of water." The Argonne National Laboratory, through Gateway for Accelerated Innovation in Nuclear (GAIN) funding, will explore "Plan B" options for cooling nuclear reactors, in an effort to future-proof new reactors in the face of a changing climate."

The practicality of dry cooling on the Susquehanna River was established in the testimony of Expert Witness Arnold Gundersen in his report regarding "Consumptive Water Use of the Susquehanna River by the Proposed Bell Bend Nuclear Power Plant." (Exhibit, #3)

Mr. Gundersen stated: (25)

38. Whereas, in an air-cooled condenser design, the steam that leaves the turbine passes directly to a dry cooling tower thus using no river water. The air-cooled condenser sits at the base of a dry cooling tower.

38.1. This design has the unique advantage of not having a secondary loop of additional river water required to cool the steam.

38.2 In the air-cooled condenser design, steam heat from the power plant passes through a tube directly into the air.

38.3. Also, in the air-cooled condenser design, steam is directly condensed by the air and then sent back into the power plant.

39. No intermediate river water is ever used in the air-cooled condenser design. Dry cooling and an air-cooled condenser have several key advantages:

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24 The Final Environmental Statement related to the selection of a Preferred Closed Cycle Cooling System at Indian Point Unit 3 NUREG 0574 Docket, November, 50-286, December, 1979.

In Appendix G of the FES for Unit Number, 3, a description of the extensive research involving environmental effects of dry and wet cooling towers using fresh and salt water as makeup is outlined. 1-5 Specific analysis can be found under 2.1 Dry Cooling.

25 In the Matter of Bell Bend Nuclear Power Plant, Application for Groundwater Withdrawal Application for Consumptive Use, BNP-2009-073), Susquehanna River basin Commission, January 5, 2010, pp. 12-13. Mr. Gundersen has qualified as an expert witness before the Nuclear Regulatory Commission (NRC) Atomic Safety and Licensing Board (ASLB) and Advisory Committee on Reactor Safeguards (ACRS), in Federal Court, the State of Vermont Public Service Board, the State of Vermont Environmental Court, and the Florida Public Service Commission.

39.1. The first advantage of dry cooling and an air-cooled condenser is that there is no consumption of river water.

39.2. The second advantage is that without dirty water (or blow down) being sent back into the river, contamination to the river is lessened.

39.3. The third advantage is that there is no cloud of hot moist air leaving the tower, so these towers never produce a cloud of water vapor that has so many additional negative meteorological, environmental, and esthetic impacts.

Mr. Gunderson noted there are two drawbacks with air cooled design:

40.1. The first drawback to the air-cooled design is that this design lowers the efficiency of the power plant slightly by increasing the backpressure on the turbine thus providing less electricity to generate and less income for the power plant owner. However, for most of the year, when temperatures are lower than 70 degrees, the efficiency of the air-cooled design is quite comparable to other cooling techniques.

40.2. The second disadvantage of the air-cooled design is that, because it is less effective at removing the heat from steam than wet evaporative cooling, the air- cooled towers are more expensive to operate than either the hyperbolic or forced air-cooling towers.

41. While installing an air-cooled condenser is slightly more expensive than the approach chosen by PPL to use on the Bell Bend project, air cooled condensers would completely eliminate the significant problem of consumptive water use of the Susquehanna River. If PPL equipped its proposed Bell Bend project with air-cooled condensers, then the Susquehanna River Watershed area would not be facing the negative environmental burden of the Bell Bend nuclear power plant's evaporative losses, including:

41.1. A withdrawal of 31 million gallons per day of water of ***make-up*** water being drawn from the Susquehanna River to cool plant, or

41.2. Any dirty water (***blowdown water)*** being returned to the Susquehanna River.

Mr. Gundersen's conclusion:

45. Moreover, changing to an air-cooled condenser and air-cooled towers will not impact any aspect of the nuclear design that has already been approved by the Nuclear Regulatory Commission.

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26 Gundersen, Expert Testimony, p.14

VI. Conclusion.

The Susquehanna River Basin Commission's Notice of Proposed Rulemaking Modifying 18 CFR Part 801, Review and Approval of Projects, is a necessary and invaluable tool in managing and preserving water in the Susquehanna River Basin. The rule strikes the right balance between commerce and conservation, and provides a down payment for future water use.

In order for the full force of this policy to have a maximum impact, there should be no exemptions for large consumptive use facilities, including but not limited to data centers, fracking facilities, and nuclear generating stations.

Three Mile Island Alert urges the Commission to approve and memorialize this proposed rule at the next business meeting scheduled for September 12, 2024

Respectfully submitted,

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Exhibit, #1.

Filed September 3, 2019
Corrected September 5, 2019

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD
AND
THE COMMISSION

In the Matter of Exelon Generation Company, LLC Peach Bottom Atomic Power Station, Units 2 & 3	)	Docket Nos. 50-277/278 SLR September 3, 2019

BEYOND NUCLEAR, INC.'S MOTION FOR LEAVE TO FILE NEW CONTENTION BASED ON DRAFT SUPPLEMENT 10 TO GENERIC ENVIRONMENTAL IMPACT STATEMENT FOR SUBSEQUENT LICENSE RENEWAL OF PEACH BOTTOM OPERATING LICENSE (CORRECTED)

I. INTRODUCTION

Pursuant to 10 C.F.R. §§ 2.309(c) and 2.309(f)(2), Beyond Nuclear, Inc. ("Beyond Nuclear") hereby moves for consideration of a new contention in this proceeding for consideration by the U.S. Nuclear Regulatory Commission ("NRC" or "Commission") of Exelon Generation Co., L.L.C.'s ("Exelon's") application for subsequent license renewal ("SLR") of its operating license for the Peach Bottom Units 2 and 3 nuclear power plant.[1] In Section III below, Beyond Nuclear's proposed Contention 3 challenges the adequacy of the Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 10, Second Renewal, Regarding Subsequent License Renewal for Peach Bottom Atomic Power Station, Units 2 and 3

[1] As discussed in greater detail in Section II below, this motion is being filed before both the Atomic Safety and Licensing Board ("ASLB") and the Commission, due to a jurisdictional question raised by the apparent incompatibility of 10 C.F.R. § 2.318(a) with the ASLB's recent order terminating this proceeding, *Exelon Generation Co., LLC* (Peach Bottom Atomic Power Station, Units 2 & 3), LBP-19-05 __ N.R.C. __ (June 20, 2019).

(NUREG-1437, Supp. 10, Second Renewal, Draft Report for Comment) (July 2019) ("Draft GEIS Supp. 10"). As discussed in Contention 3, the Draft GEIS Supp. 10 fails to satisfy the National Environmental Policy Act ("NEPA") or NRC implementing regulations because it lacks an adequate discussion of the environmental impacts of design basis accidents.[2]

II. JURISDICTION

In LBP-19-05, the ASLB denied Beyond Nuclear's initial hearing request and terminated this proceeding. *Id.,* slip op. at 24. Thus, LBP-19-05 appears to have ended the ASLB's jurisdiction over any new or supplemental hearing requests, including this one. However, Beyond Nuclear has appealed LBP-19-05 to the NRC Commissioners and no final decision has issued yet. Therefore, 10 C.F.R. § 2.318(a) appears to countermand the ASLB and give the Presiding Officer continuing jurisdiction to consider new contentions up until the time of a decision by the Commissioners.[3] *See also USEC, Inc.* (American Centrifuge Plant), Order (Regarding Jurisdiction) (Unpublished, Oct. 20, 2005) (NRC Accession No. ML052930319). Under the circumstances, and in an abundance of caution, Beyond Nuclear has filed this motion before both the ASLB and the Commission in order to ensure that this motion is considered by the appropriate body.

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[2] Beyond Nuclear has standing to participate in this proceeding, as established in LBP-19-05.

[3] As stated in the regulation: "The presiding officer's jurisdiction in each proceeding terminates when the period within which the Commission may direct that the record be certified to it for final decision expires, when the Commission renders a final decision, or when the presiding officer withdraws from the case upon considering himself or herself disqualified, whichever is earliest."

III. CONTENTION 3

A. Statement of Contention

The Draft GEIS Supp. 10 violates NEPA and NRC implementing regulation 10 C.F.R. § 51.71 in three significant ways:

1. The GEIS purports to rely on the Category 1 determination that design-basis accidents have no significant impacts, as set forth in Table B-1 of 10 C.F.R. Part 51, Subpart A, Appendix A. *Id.* at 4-99 ("[T]he GEIS (NRC 2013a) addresses design-basis accidents as a Category 1 issue and concludes that the environmental impacts of design-basis accidents are of SMALL significance for all nuclear power plants."). Table B-1, however, applies only to initial license renewal and not to subsequent license renewal. *See* Section III.B.2 below. Thus, NEPA requires that the Draft GEIS Supp. 10 must present a full discussion that "considers and weighs the environmental effects" of operating Peach Bottom Units 2 and 3 for an additional twenty years. 10 C.F.R. § 51.71(d). *See also Robertson v. Methow Valley Citizens Council,* 490 U.S. 332, 349 (1989 (NEPA requires a federal agency to take a "hard look" at potential environmental consequences by preparing an EIS prior to any "major Federal action[] significantly affecting the quality of the human environment.").
2. Because it relies on Category 1 and Table B-1, the Draft GEIS Supp. 10 does not claim to have incorporated the 1996 License Renewal GEIS and the 2013 Revised License Renewal GEIS by reference pursuant to 10 C.F.R. § 51.71(a). If the Staff intends to incorporate the 1996 and 2013 environmental analyses into Draft GEIS Supp. 10, it should explicitly make that assertion and follow NRC regulations and guidance for incorporation by reference. *See Florida Power & Light Co.* (Turkey Point Nuclear

Generating, Units 3 and 4), LBP-16-08, 83 N.R.C. 417, 432 and n. 98 (2016), *aff'd on other grounds,* CLI-16-18, 84 N.R.C. 167 (2016) (holding that to incorporate another environmental study by reference, an environmental document must (1) make specific reference to the material incorporated, (2) consider environmental changes that occurred after the incorporated study was prepared, and (3) consider the environmental effects of the specific license at issue.). *See also* 40 C.F.R. § 1502.21 (adopted in 10 C.F.R. Part 51, Subpart A, App. A § 1(b)); and NUREG-1555, Standard Review Plans for Environmental Reviews for Nuclear Power Plants (Oct. 1999)) (the Staff's own guidance for preparing environmental impact statements).

3. Appendix E of Draft GEIS Supp. 10 does contain one brief and specific discussion of the findings of the 1996 License Renewal GEIS and the 2013 Revised License Renewal GEIS in relation to Peach Bottom:

> As stated in Section 5.3.2 of the 1996 GEIS, the NRC staff assessed the environmental impact from design-basis accidents in the individual plant-specific EISs at the time of the initial license application review. Since the licensee is required to maintain the plant within acceptable design and performance criteria, including during any license renewal term, the NRC staff would not expect environmental impacts to change significantly. Therefore, additional assessment of the environmental impacts from design-basis accidents is not necessary (NRC 2013a).

Id. at E-2. However, this discussion is legally deficient in the following respects:

a. First, Draft GEIS Supp. 10 does not address significant developments that have occurred since the 2013 Revised License Renewal GEIS was issued. *Florida Power & Light Co.,* 83 N.R.C. at 432, or even claim to have surveyed the current level of knowledge regarding accident risks posed by operating nuclear reactor safety equipment beyond 60 years. The NRC has expended considerable time and resources studying the effects of long-term aging on the safety of nuclear reactor

operation, and has found significant uncertainties in current understanding of how aging may affect the safety of reactor operation in the future. Yet, the Draft GEIS Supp. 10 contains no mention of this work. Studies that should have been addressed, for example, include a five-volume report issued by the NRC in 2014, the Expanded Materials Degradation Assessment ("EMDA"). NUREG/CR-7153, ORNL/TM-2013/532, Oct. 2014) ("EMDA Report"). The EMDA Report identifies multiple examples of knowledge deficiencies regarding management of aging reactor safety equipment. *See* Section III.B.3 below for greater factual detail. Similarly, the Draft GEIS Supp. 10 fails to address the environmental implications of reactor aging issues identified by the NRC Staff in SECY-14-0016, Memorandum from Mark A. Satorius, NRC Executive Director of Operations, to NRC Commissioners, re: Ongoing Staff Activities to Assess Regulatory Considerations for Power Reactor Subsequent License Renewal (Jan. 31, 2014) (NRC ADAMS Accession No. ML14050A306). These issues, characterized by the Staff as "the most significant technical issues challenging [reactor] operation beyond 60 years," include reactor pressure vessel embrittlement; irradiation-assisted stress corrosion cracking of reactor internals, concrete structures and containment degradation; and electrical cable qualification and condition assessment. *Id.,* Enclosure 1 at 2-3. As stated by senior NRC management, "it is the industry's responsibility to resolve these and other issues to provide the technical bases to ensure safe operation beyond 60 years." *Id.* at 3. Beyond Nuclear is aware of no determination that these issues have been resolved since publication of SECY-14-0016.

b. By stating that the NRC's regulatory requirements for safe operation under the Atomic Energy Act will ensure that no changes occur in the severity of environmental impacts of design-basis accidents at Peach Bottom Units 2 and 3, the NRC Staff confuses Atomic Energy Act compliance with NEPA compliance. It is well-established that NEPA's requirements are independent of other statutes and must be complied with "unless specifically excluded by statute or existing law makes compliance impossible." *Limerick Ecology Action v. NRC,* 869 F.2d 719, 729 (3rd Cir. 1989) (citing *Public Service Co. of New Hampshire v. NRC,* 582 F.2d 77, 81 (1st Cir. 1978)). Both the EMDA Report and SECY-14-0016 identify significant uncertainties regarding the safety of operating nuclear reactors during a second license renewal term, due to a lack of knowledge regarding the behavior of safety components that have aged more than sixty years. Any "reasonable assurance" finding made by the NRC under the Atomic Energy Act regarding the safety of operating Peach Bottom for more than sixty years "does not describe a probability of failure so low as to dismiss the potential consequences of such a failure." *State of New York v. NRC,* 681 F.3d 471, 478 (D.C. Cir. 2012). In *State of New York,* the court found that a "reasonable assurance" finding regarding the likelihood that permanent spent fuel storage will be available was "a far cry from finding the likelihood of nonavailability to be 'remote and speculative.'" *See also* 40 C.F.R. § 1502.22, which provides "guidance" to the NRC (74 NRC at 444) that "when an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in

an environmental impact statement and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking." Here, having identified significant and unresolved uncertainties regarding the safety of operating nuclear reactors far into the future with aging equipment, the NRC has no basis for equating a reasonable assurance finding with a finding of no significant environmental impacts.

B. Basis Statement

1. Introduction: Requirements of NEPA

NEPA implements a "broad national commitment to protecting and promoting environmental quality." *Louisiana Energy Services, L.P.* (Claiborne Enrichment Center), CLI-98-3, 47 NRC 77, 87 (1998) (quoting *Robertson v. Methow Valley Citizens Council,* 490 U.S. 332, 348 (1989) and citing 42 U.S.C. § 4331). NEPA has two key purposes: to ensure that the agency "will have available, and will carefully consider, detailed information concerning significant environmental impacts" before it makes a decision; and to guarantee that "the relevant information will be made available to the larger audience that may also play a role in the decision-making process and implementation of that decision." *Robertson*, 490 U.S. at 349.

In fulfilling NEPA's first purpose of evaluating the environmental impacts of its decisions, NEPA requires a federal agency to take a "hard look" at potential environmental consequences by preparing an EIS prior to any "major Federal action[] significantly affecting the quality of the human environment." *Robertson,* 490 U.S. at 349; 42 U.S.C. § 4332(c). The "hallmarks of a 'hard look' are thorough investigation into environmental impacts and forthright acknowledgment of potential environmental harms." *National Audubon Society v. Dep't of Navy*, 422 F.3d 174, 185 (4th Cir. 2005).

In fulfilling NEPA's second purpose of public participation, the agency's environmental analysis must be published for public comment "to permit the public a role in the agency's decision-making process." *Robertson,* 490 U.S. at 349-50; *Hughes River Watershed Conservancy v. Glickman,* 81 F.3d 437, 443 (4th Cir. 1996). NRC's Part 51 regulations also allow interested members of the public to participate in the environmental decision-making process through the NRC's hearing process. 10 C.F.R. §51.104(a).

2. NRC implementing regulations do not allow application of Category 1 determinations to subsequent license renewal applicants.

NRC regulations in 10 C.F.R. Part 51 establish parallel sets of requirements for both license applicants and the NRC Staff. This regulatory scheme must be seen as a whole because the NRC Staff bases its own environmental analyses on environmental reports prepared by license applicants. In addition, both sets of regulations rely for provisions related to license renewal on the same GEIS: the 1996 License Renewal GEIS as revised in 2013.

a. NRC's NEPA implementing regulations contain no exemptions for consideration of environmental impacts in environmental reports for subsequent license renewal applications.

10 C.F.R. § 51.53(c)(2) establishes general requirements for environmental reports by license renewal applicants. Section 51.53(c)(2) requires an operating license renewal applicant (other than an applicant for initial license renewal) to describe, *inter alia,* "the affected environment around the plant," the "environmental impacts of alternatives," and "any other matters described in § 51.45(a)." Section 51.45(a), requires, in turn, that the Environmental Report must include the following information:

> *Analysis*. The environmental report must include an analysis that considers and balances the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and alternatives available for reducing or avoiding adverse environmental effects. . . . The environmental report must also contain an analysis of the cumulative impacts of the activities to be authorized by the limited work

> authorization, construction permit, or combined license in light of the preconstruction impacts described in the environmental report. . . . The analyses for environmental reports shall, to the fullest extent practicable, quantify the various factors considered. To the extent that there are important qualitative considerations or factors that cannot be quantified, those considerations or factors shall be discussed in qualitative terms. The environmental report should contain sufficient data to aid the Commission in its development of an independent analysis.

The NRC has no NEPA regulations that apply to subsequent license renewal applicants. Applicants seeking an "initial renewed license," however, may rely on 10 C.F.R. § 51.53(c)(3) to be excused from addressing "Category 1" environmental impacts in Table B-1 of 10 C.F.R. Part 51, Subpart A, Appendix A. The rationale for the Category 1 exemptions is that their environmental impacts were generically addressed in the 1996 License Renewal GEIS, as revised in 2013. Table B-1, note 1. In its Environmental Report, Exelon has disregarded the plain language of 10 C.F.R. § 51.53(c)(3) and omitted discussion of all Category 1 environmental impacts, including the environmental impacts of design-basis accidents. *Id.* By its own terms, however, Section 51.53(c)(3) applies only to applicants "seeking an *initial* renewed license" and not to applicants for subsequent license renewal like Exelon. *See also* Proposed Rule, Environmental Review for Renewal of Nuclear Power Plant Operating Licenses, 56 Fed. Reg. 47,016, 47,017 (Sept. 17, 1991) (stating that "the part 51 amendments [including 10 C.F.R. § 51.53(c)(3) and Table B-1 in Appendix B of 10 C.F.R. Part 51] apply to one renewal of the initial license for up to 20 years beyond the expiration of the initial license.").

b. NRC's NEPA implementing regulations contain no exemptions for consideration of environmental impacts in environmental impact statements for subsequent license renewal applications.

The NRC's general regulations for the content of environmental impact statements prepared by the agency staff are found in 10 C.F.R. § 51.71. Requirements for environmental impact statements for license renewal are found in 10 C.F.R. § 51.71(d) and 10 C.F.R. §

51.95(c). Section 51.71(d) states that a draft supplemental environmental impact statement for license renewal "will rely on conclusions as amplified by the supporting information in the [License Renewal] GEIS for issues designated as Category 1 in appendix B to subpart A of this part." The reference to "appendix B" is to Table B-1, which lists design-basis accidents as Category 1 environmental impacts. And Table B-1 relies in turn on the 1996 License Renewal GEIS, as revised in 2013, for its determinations regarding the insignificance of environmental impacts designated as Category 1. *See* Table B-1, note 1.

Sections 51.71(d), and § 51.95(c) were promulgated in 1996, at the same time the License Renewal GEIS was issued. There is no mention of subsequent license renewal in the proposed version of that rule (Proposed Rule, Environmental Review for Renewal of Nuclear Power Plant Operating Licenses, 56 Fed. Reg. 47,016 (Sept. 17, 1991)); in the final rule (Final Rule, Environmental Review for Renewal of Nuclear Power Plant Operating Licenses 61 Fed. Reg. 28,467 (June 5, 1996)); or in the 1996 License Renewal GEIS that supports 10 C.F.R. § 51.71(d) and the Category 1 determinations of Table B-1. To the contrary, the 1996 License Renewal GEIS describes the "proposed action" addressed by the GEIS as allowing nuclear power plants to operate "for a maximum of 20 years past the terms of their *original* 40-year operating licenses." *Id.* at 2-28 – 2-29 (emphasis added).

Similarly, there is no mention of subsequent license renewal in the 2009 proposed amendments to the 1996 Final Rule (Proposed Amended Rule, 74 Fed. Reg. 38,117 (July 31, 2009)); or the 2013 Final Rule amending the 1996 rule (Final Amended Rule, 78 Fed. Reg. 37,312 (June 20, 2013)). Nor is there any mention of subsequent license renewal in the 2013 Revised License Renewal GEIS. Instead, the 2013 Revised License Renewal GEIS simply

"reviews and reevaluates" the findings of the 1996 License Renewal GEIS. *Id.* at 1-7.[4] *Nowhere* does the 2013 Revised GEIS refer to a time frame totaling 80 years or a baseline of 60 years.[5]

Furthermore, in no proposed or final version of NRC regulations for the implementation of NEPA did the NRC change the language of 10 C.F.R. § 51.53(c)(3) to allow application of Category 1 environmental findings by any license renewal applicants other than "applicants seeking an initial renewed license."

In 10 C.F.R. § 51.71(d), the NRC simply had no reason to state that the Category 1 exception applied only to initial license renewals, because neither the rule nor the underlying 1996 GEIS applied to anything *other than* initial license renewals (*i.e.*, 40 plus 20 years). The 1996 GEIS explicitly describes the "proposed action" addressed by its analysis as allowing nuclear power plants to operate "for a maximum of 20 years past the terms of their *original* 40-year operating licenses." 1996 GEIS at 2-28–29 (emphasis added). The NRC could not allow licensees to rely upon generic review of Category 1 issues beyond the initial license renewal

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[4] For instance, the 2013 Revised GEIS asserts that the 1996 GEIS' conclusions regarding the environmental impacts of refurbishment activities are "valid and conservative." *Id.* at 2-3. And the 2013 Revised GEIS concludes that "[d]uring the license renewal term, commercial nuclear power plants would continue to operate in the same manner as they had during the *original* license term." *Id.* (emphasis added)

[5] In SECY-14-0016, the NRC Staff expressed its opinion that the 2013 Revised License Renewal GEIS is adequate to support subsequent license renewal. *Id.* at 3. But SECY-14-0016 does not state, nor does any evidence exist, that the 2013 Revised License Renewal GEIS specifically examined the environmental impacts of operating reactors for an additional twenty years beyond the initial renewed license term. The opinion of the NRC Staff is just an opinion. Unless it is published and offered for public comment, it cannot be relied upon to expand the scope of the 1996 GEIS or the 2013 Revised GEIS. *Perez v. Mortg. Bankers Ass'n*, 135 S. Ct. 1199, 1206 (2015) ("agencies [must] use the same procedures when they amend or repeal a rule as they used to issue the rule in the first instance.").

In any event, it is not possible to reconcile its opinion that the 2013 Revised License Renewal GEIS is adequate to support subsequent license renewal with its opinion – stated in the same memorandum – that subsequent license renewal raises technical issues that must be resolved in order to ensure safe operation. *See* Enclosure 1 at 2-3.

term, because the agency never conducted a generic environmental analysis of impacts beyond the 60-year time frame to justify it. Thus, the NRC had no reason to state that Table B-1 would apply to subsequent license renewal applications (*i.e.*, 60 plus 20 years). The NRC *did* have a reason to notify license applicants that § 51.53(c)(3) (and hence Table B-1) would only apply to the initial license renewal term, however. Having told licensees that "[n]o limit on the number of license renewals is specified" in NRC's Part 54 regulations,[6] the NRC reasonably clarified that the scope of its license renewal review under NEPA would be more limited in § 51.53(c)(3).

2. Factual basis

A review of the literature on aging reactors demonstrates the existence of a number of age-related issues whose implications for environmental risk should be addressed in Draft GEIS Supp. 10. For instance, the 2014 EMDA Report, prepared by the NRC and the DOE, raised concerns regarding "increased susceptibility to known degradation modes" and "new mechanisms" of degradation during reactor operation after 60 years, as follows:

> Extending reactor operation to beyond 60 years will increase the demands on materials and components. While operation beyond 60 will add additional time and neutron fluence, the primary impact will be increased susceptibility to known degradation modes, although new mechanisms are possible.
>
> For the reactor core and primary systems, several key issues have been identified. Thermomechanical considerations such as aging and fatigue must be examined. Irradiation-induced processes must also be considered for higher fluences, particularly the influence of radiation induced segregation (RIS), swelling, and/or precipitation on embrittlement. Corrosion takes many forms within the reactor core and piping systems, although irradiation assisted stress corrosion cracking (IASCC) and PWSCC [primary water stress corrosion cracking] are of high interest in extended life scenarios.
>
> Research in these areas can build upon other ongoing programs in the light water reactor (LWR) industry as well as other reactor materials programs (such as fusion and fast reactors) to help resolve these issues for extended LWR [light water reactor] life. In the secondary systems, corrosion is extremely complex. Understanding the various modes of corrosion and identifying mitigation strategies is an important step for long-term service.

[6] 1996 GEIS at 1-1.

> For reactor pressure vessels, a number of significant issues have been identified for future research. Relatively sparse or nonexistent data at high fluences, for long radiation exposure (duration), and resulting high embrittlement create large uncertainties for embrittlement predictions. The use of test reactors at high fluxes to obtain high fluence data is not the most direct representation of the low flux conditions in RPVs. Late-blooming phases (LBPs), especially for high nickel welds, have been observed and additional experimental data are needed in the high fluence regime where they are expected. Other discussed issues include specific needs regarding application of the fracture toughness master curve, data on long term thermal aging, attenuation of embrittlement through the RPV wall, and the development of an embrittlement trend curve based on fracture toughness measurements.
>
> Concrete structures can also suffer undesirable changes in properties with time, including adverse performance of its cement paste matrix or aggregate constituents under environmental influences (e.g., physical or chemical attack). Changes to embedded steel reinforcement as well as its interaction with concrete can also be detrimental to concrete's service life. Aging effects can be exacerbated if improper concrete specifications were used at the time of construction. A number of areas of research would help assess the long-term integrity of the reactor concrete structures.
>
> Cable and cable insulation systems play an important role in the safety and operation of a nuclear power plant. Degradation of polymer insulation due to the combined effects of mechanical stress, elevated temperature, irradiation and high humidity environments (or complete submergence) has been observed, although there may be knowledge gaps for reactor long term operation.

EMDA Report, Vol. 1 at 3-4 (ML14279A321). The EMDA recommended further research on these issues, and there is no indication they have been resolved.

SECY-14-0016, a high-level NRC memorandum to the Commissioners, also identifies a range of unresolved issues related to the safety of operating aging reactor equipment beyond 60 years. The NRC Staff has instructed licensees that they must "resolve" issues related to reactor pressure vessel embrittlement; irradiation-assisted stress corrosion cracking of reactor internals, concrete structures and containment degradation; and electrical cable qualification and condition assessment, in order to "provide the technical bases to ensure safe operation beyond 60 years." SECY-14-0016, Enclosure 1 at 2-3. Again, there is no indication that these issues have been

resolved. The uncertainties raised by the EMDA Report and SECY-14-0016 regarding the risks of design-basis accidents must be addressed in order to satisfy NEPA.

C. Demonstration that the Contention is Within the Scope of the Proceeding

Contention 3 is within the scope of this SLR proceeding because it raises issues of compliance with NEPA and NRC regulations for implementation of NEPA.

D. Demonstration that the Contention is Material to the Findings NRC Must Make to renew Exelon's operating license

Contention 3 is material to the findings that NRC must make in order to ensure that the NEPA review of Exelon's operating license application adequately considers the environmental impacts of operating Peach Bottom Units 2 and 3 for twenty additional years beyond its current 60-year operating license term.

E. Concise Statement of the Facts or Expert Opinion Supporting the Contention, Along with Appropriate Citations to Supporting Scientific or Factual Materials

As detailed in Section B. above (Basis Statement), Contention 3 relies on the facts and opinions stated by NRC officials in SECY-14-0016 and the EMD Report.

IV. BEYOND NUCLEAR HAS GOOD CAUSE TO FILE THIS MOTION AFTER THE INITIAL DEADLINE FOR HEARING REQUEST.

Beyond Nuclear satisfies the three requirements of 10 C.F.R. § 2.309(c)(1) for establishing good cause to submit Contention 3 after the initial November 11, 2018 deadline for filing hearing requests on Exelon's subsequent license renewal application. First, the information on which Contention 3 is based "was not previously available." 10 C.F.R. § 2.309(c)(1)(i). The NRC Staff's analysis of the environmental impacts of operating Peach Bottom Units 2 and 3 for a second license renewal term did not exist before publication of the Draft GEIS Supp. 10.

Second, the information upon which the amendment to the contentions is based is "materially different" from the information that was previously available in Exelon's Environmental Report. 10 C.F.R. § 2.309(c)(1)(ii)). Draft Supp. 10 and the Environmental Report are materially different in the respect that they rely on different regulations to justify the applicability of Table B-1; and because the Draft GEIS Supp. 10 contains a discussion of the environmental impacts of design-basis accidents that did not appear in the Environmental Report.

Finally, this motion has been submitted in a "timely fashion based on the availability of the subsequent information." Beyond Nuclear's counsel received an e-mail notice of the availability of Draft Supp. 10 on August 3, 2019. *See* Attachment, E-mail to Diane Curran from nrc_mail_2-1.Resource@nrc.gov re: Notice of Availability Of Draft Supplement 10, Second Renewal To The Generic Environmental Impact Statement For License Renewal of Nuclear Plants Regarding Subsequent License Renewal For Peach Bottom Atomic Power Station Units 2 and 3. (While the message itself is dated August 2, counsel for Beyond Nuclear did not receive it until August 3 as shown by the attached cover sheet.) Contention 3 is being filed within 30 days of that notice, and therefore the timing of Contention 3 is reasonable. *See, e.g., Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc.* (Vermont Yankee Nuclear Power Station), LBP-07-15, 66 N.R.C. 261, 266 n.11 (2007) (finding that timeliness of contentions depends on "the facts and circumstances of each situation" and noting the general application of a 30-day period by many licensing board panels).

V. CONCLUSION

For the foregoing reasons, the ASLB or the Commission should admit Contention 3.

Respectfully submitted,

/signed electronically by/
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September 3, 2019

Exhibit, #2.

Technical Review: Susquehanna River Basin Commission Docket Numbers: Three Mile Island Nuclear Station, Unit 1 - Well A - 2021-054; Three Mile Island Nuclear Station, Unit 1 - Well B - 2021-055; and, Three Mile Island Nuclear Station, Unit 1 - Well C - 2021-056.

January 3, 2022

Manager, Project Review
Susquehanna River Basin Commission
4423 North Front Street
Harrisburg , PA 17110-1788

Dear Project Manager:

Eric Joseph Epstein ("Epstein" or "Mr. Epstein") and TMI-Alert ("TMIA" or "TMI-Alert") jointly referred to as the Petitioners, are presenting background information and detailed concerns regarding the above-captioned application. Specific technical concerns and questions relating to Susquehanna River Basin Commission ("SRBC") Pending Nos. 2021-054, 2021-055, & 2021-056) are identified as issues in II. Three Mile Island Nuclear Station, Unit-1, Post-Shutdown Decommissioning Activities and Water Use; III. Three Mile Island Unit-2, Post-Defueling Monitored Storage; and, IV. Concerns and Issues with the SRBC Application are broken out per the SRBC Application Protocol.

Respectfully Submitted,

Eric Epstein, Chairman
TMI-Alert, Inc.
4100 Hillsdale Road
Harrisburg, PA 17112
epstein@efmr.org

cc: Service List

I. Introduction.

Three Mile Island Unit-1 ("TMI-1)) was owned and operated by the former Exelon Corporation ("Exelon"). Inexplicably, all the water resources at Three Mile Island ("TMI"), including water used by Three Mile Island Unit-2 ("TMI-2"), which is owned by a separately licensee, TMI-2 Solutions, LLC., is under contract to Exelon Corporation. The new Exelon, or "Hold Co" and "Spin Co", has been reorganized, and has no name, address, or organizational structure during the review of this application. (1) The former Exelon submitted a TMI Unit 1 application, which as specified in Commission Regulation 18 CFR §806.31(e), allows continued operation of the groundwater wells under Susquehanna River Basin Commission ("SRBC") Docket No. 20110610 beyond the November 26, 2021 expiration date. Both entities, the former Exelon and TMI-2 Solutions, LLC, are divisible and refereed to as the "Applicant."

Exelon, the former-owner of TMI Unit-1, filed applications for renewal of groundwater withdrawals from three wells for ongoing water demands to continue operations at the facility. The applications request approval to withdraw groundwater at a consecutive 30-day average of up to 0.099 million gallons per day ("mgd") from Well A, up to 0.099 mgd from Well B, up to 0.099 mgd from Well C, and up to 0.099 mgd from Wells A, B, and C combined. The applications extend to TMI-2

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1 Mr. Epstein and TMI-Alert are parties to the proceeding Docket Nos. STN 50-456, STN 50-457, 72-73, STN50-454, STN 50-455, 72-68, 50-317, 50-318, 72-8, 50-461, 72-1046, 50-10, 50-237, 50-249, 72-37, 50-333, 72-12, 50-373, 50-374, 72-70, 50-352, 50-353, 72-65, 50-220, 50-410, 72-1036, 50-171, 50-277, 50-278, 72-29, 50-254, 50-265, 72-53, 50-244, 72-67, 50-272, 50-311, 72-48, 50-289, 72-77, 50-295, 50-304, and 72-1037-LT.

TMI-2 Solutions, a separately owned and operated limited liability corporation, that is in possession of the the TMI-2 Possession Only License ("POL").

Enclosed please find Eric Epstein ("Epstein" or Mr. Epstein") and Three Mile Island's Alert, Inc.'s ("TMIA" ot "TMI-Alert") (jointly the Petitioners") review of the Applications for water use. The Susquehanna River Basin Commission (2) stated on October 27, 2021: "The applications are currently undergoing administrative and technical review. (3) Recognizing the change in operations, (4) Commission staff will review the water withdrawal and consumptive use demands, from all sources, based on the Facility's reasonable and foreseeable need to adequately address ongoing decommissioning activities (including TMI-2). There is no information
related to the review of the pending applications currently available for public dissemination."

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2 SRBC docket numbers: Three Mile Island Nuclear Station, Unit 1 - Well A - 2021-054; Three Mile Island Nuclear Station, Unit 1 - Well B - 2021-055; and, Three Mile Island Nuclear Station, Unit 1 - Well C - 2021-056.

3 The Applicants incorrectly referred to the project Sponsor as "Three Mile Island Island Nuclear Station Unit located in "Middleton." "Exelon" is identified as the owner under Table 4.2." However, "Middleton" is a city located in Massachusetts or Wisconsin, and TMI is located in Londonderry Township. The company in possession of the license was Exelon which has Spun ito an unidentified Hold Co and Spin Co with no current address, name or organization. The NRC's preliminary approval was granted on November 17, 2021.

4 Re: Exelon Generation Company, LLC - Approval of Indirect Transfer of Licenses and Draft Conforming License Amendments, (November 17, 2021).

Three Mile Island is in an "abnormal condition," (5) which informs the demand for water. Water use was substantial during the TMI-2 defueling phase which created a legal precedent. (6) The defueling process generated 2.3 million gallons of radioactive water that was evaporated.

There are significant costs to remove dissolved and suspended impurities for purposes of radiological protection and water clarity. These systems will likely include modifications of more conventional systems

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4 Draft Amendments: ML21277A193

ADAMS Accession Nos. Order: ML21277A192.
https://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber=ML21277A192
https://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber=ML21277A193

Safety Evaluation (Non-Proprietary): ML21277A248.
https://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber=ML21277A248

5 "The basement of the reactor building has been uninhabitable since the accident. Under a 1982 agreement with the Nuclear Regulatory Commission and the Department of Energy. GPU Nuclear was able to ship 'abnormal' radioactive waste, that is waste not suitable for commercial disposal, from TMI-2 to the DOE for storage, research and ultimate disposal." (Three Mile Island Nuclear Station, Unit 2, No. DPR-73 Docket Nos. 50-320, February 1, 2005).

6 In June 1980, the Susquehanna Valley Alliance filed a Complaint and Injunction with the Middle District Court in Harrisburg, Pennsylvania against the Nuclear Regulatory Commission and Metropolitan Edison. The Injunction sought to prevent the owner and operator of Three Mile Island from dumping 700,000 gallons of radioactive water into the Susquehanna River. The Injunction was granted, and the NRC was found to be in violation of the National Environmental Policy Act.

during defueling, decontamination, and decommissioning including, but not limited to the ion exchange resins, Submerged Demineralizer Systems, and processing and disposal of water and water filters and treatment media. (Please refer to Exhibit, A.)

Three Mile Island's "abnormal" and "unique status", (7) dual ownership, fluid timetables, "minimum funding levels," and uncertainty of decommissioning modes, can not be ignored when computing site-specific, water use needs at TMI-1 or TMI-2.

Three Mile Island is identified as "unique" by the Nuclear Regulatory Commission and the Commonwealth of Pennsylvania's Department of Environmental Protection ("DEP") Secretary, Patrick McDonnell, who reiterated TMI-2's "unique status" in a letter to Kristine L. Svinicki, former Chairman of the U.S. Nuclear Regulatory Commission from April 6, 2020. "Given my stated concerns, I hope you and your fellow Commissioners will thoughtfully consider the unique aspects of the severely damaged TMI Unit-2 nuclear reactor..."

The Applicants have attempted to dilute and "normalize" the core melt accident at Three Mile Island. TMI-2 Solutions told the NRC during a presentation they wanted to normalize TMI-2 (Slide, 15). "We don't want it to look like apples to oranges. We want to keep it consistent. License foot

7 TMI-2's "uniqueness" was reaffirmed by TMI-2 in its Application before the Nuclear Regulatory Commission, Attachment 1, p. 12 and Attachment 1 on p. 209, and the "Amended Post Shutdown Decommissioning Activities Report, on p. 16 and in the Affidavit of Russell G. Workman.

print is identical [to TMI-1.]" TMI-Solutions proposed reframing the meltdown to look, "Like any other plant at the end of its life" after Phase 1. (8)

The delay in cleaning up TMI-2 had to do with the fact that the licensee did not have the resources or ability to generate revenue. In fact much of the discussion in the Program Environmental Impact Statement ("PEIS") evolves around the issue of limited resources. In 1988, the NRC stated, "Although the duration of the storage period was not specified by the license, the NRC evaluated delayed cleanup assuming a storage period of 20 years." (PEIS, Supplement 3, April, 1988.) The NRC's 20 year guestimate was made 33 years ago.

The Petitioners have a legitimate concern that another delay will take place. Chronic underfunding and perennial delays are the signature of the TMI-2 cleanup. The most confusing aspect of the Application is the fact that the Applicant's License Transfer Application ("LTA"), and Amended PSDAR explicitly anticipate an indefinite period for SAFSTOR — during DECON - if TMI-2 becomes resource challenged. However, water needs should be based on the DECON model since SAFSTOR is a euphemism for dormant and means the opposite of "accelerated." The paradox is that the longer the cleanup is delayed, the more money are accumulated in the trust funds.

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8 "Environmental Regulatory Approach to TMI-2 Decommissioning," GPU Nuclear and TMI-2 Solutions, Slide 15, February 20, 2020.

The TMI-2 Application states, "Although TMI-2 Solutions will pursue an accelerated Decommissioning schedule after acquiring TMI-2, as demonstrated in Enclosure 7, the NDT [Nuclear Decommissioning Trust] will still provide sufficient funding for Decommissioning, accounting for fund growth up through 2037. Moreover, the Purchase Agreement does not prevent TMI-2 Solutions from deferring active Decommissioning work, if necessary, to preserve or grow NDT funds. (9) TMI-2 Solutions is advertising that it reserves the right to stop the cleanup midstream, and bank Susquehanna River Basin Commission groundwater assets.

Patrick McDonnell, Secretary of the Department of Environmental Protection wrote Kristine L. Svinicki, Chairman U.S. Nuclear Regulatory Commission on April 13, 2020, and stated "...the obvious risk of a funding shortfall and the attendant significant health, safety, environmental, financial and economic risks to the Commonwealth and its citizens raise serious questions about the realization of that benefit...GPU Nuclear Corporation and the NRC currently have $800 million in its financial assurance fund for decommissioning TMI Unit-2. However, estimates have shown it will cost $1.2 billion to decommission TMI Unit-2.

The Memorandum of Understanding between Exelon and First Energy was predicated on the assumption that both plants would be decommissioned at the same time to reduce costs and streamline resources. However, Exelon has asked the NRC to place TMI-1 in SAFSTOR while TMI-2 Solutions is requesting to move TMI-2 from PDMS /SAFSTOR to DECON until they run out of money.

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9 Application, Attachment 1 to TMI-19-112. Page 11 of 15 funds.)

The SRBC can not determine the amount of water needed to clean up either unit until Exelon and TMI-2 Solutions decide how and when they will decommission their nuclear reactors.

II. Three Mile Island Nuclear Station, Unit 1 Post-Shutdown Decommissioning Activities and Water Use.

The Generic Environmental Impact Statement ("GEIS') from the relicensing proceeding was grandfathered at Three Mile Island Unit-1, and remains the guiding environmental document. The GEIS guestimates that quantities of water required during decommissioning are minimal compared to those used when a plant is operating. The GEIS mentions construction dust abatement and decontamination (flushing systems or pressure-washing components) as typical decommissioning water uses. NRC asserted in Section 4.3.2 of the GEIS that "potential impacts of decommissioning on water use at all plants is neither detectable or destabilizing."

TMI-1 obtains surface water from the center channel of the Susquehanna River for circulating water and service water cooling, and discharges to the same channel downstream from the intake structure. Onsite groundwater wells supply water for domestic water consumption, cooling water makeup, and other industrial uses.

Exelon expects to reduce Susquehanna River water and groundwater withdrawals substantially following plant shutdown, yet the current *de minimis* need for water use at TMI-2 will increase significantly. Upon plant shutdown, the discharge of waste heat via the cooling towers or to the

Susquehanna River will end, which will eliminate most evaporative losses resulting from station operation. Water consumption will be further reduced when it is no longer necessary to provide secondary cooling for the spent fuel pool. The spent fuel pool will be used until all the spent fuel is moved into dry storage.

TMI-1 's industrial groundwater use is associated with evaporation from the plant's industrial cooler water system and makeup to the spent fuel pool. Industrial groundwater use will be phased out early in the SAFSTOR dormancy period. No timeline has been provided.

Exelon expects water use during TMl-1 decommissioning to be much lower than water use during operational years, which is consistent with the statements made in the GEIS. There is nothing about TMl-1's design, location, configuration, operating history, or decommissioning plans that would alter or contradict this generic conclusion. Exelon concludes that decommissioning water use impacts for TMI-1 are bounded by the analysis in the GEIS.

Preparations for dormancy at TMI-1 under 2.1.1 require a negligible amount of water. "The facility is left intact (during the dormancy period), with most structures maintained in a stable condition; some outbuildings not related to power production will be removed." (10)

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10 U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001 Three Mile Island Nuclear Station, Unit 1 Renewed Facility Operating License No. DPR 50 NRC Docket No. 50 289. April 5, 2019, p. 10.

The process of placing the plant in safe-storage will include, but is not limited to, the following activities that require water: management of the spent fuel pool and reconfiguring fuel pool support systems, processing and disposal of water and water filter and treatment media (resins) not required to support dormancy operation.

"Groundwater at the station is prevented from migrating beneath the river to the mainland by the opposing flow of groundwater from higher land to either side of the river. If any localized alteration in the groundwater chemistry associated with the use of crushed concrete as clean fill were to occur, it would not impact offsite groundwater quality."

Issue, #1: How much water will be required, who will analyze and monitor water chemistry, where will effluent discharge monitors be located, who and how often will water temperatures be monitored during discharges into the Susquehanna River, and what is the net monthly water loss?

The transition from decommissioning preparation to destructive decommissioning will require additional water. "Following the preparations for decommissioning, physical decommissioning activities will take place. This includes the removal and disposal of contaminated and activated components and structures, leading to the termination of the 10 CFR Part 50 operating license. Although much of the radioactivity will decrease during the dormancy period due to decay of 60 Co and other short- lived radionuclides, the internal components of the reactor vessel will still exhibit radiation dose rates that will likely require remote sectioning under water due to the presence of long-lived radionuclides such as 94 Nb, 59 Ni, and 63 Ni. (2.1.4., Decommissioning Operations: Decontamination and Dismantlement).

TMI-1 will reduce radiation levels until residual levels indicate that the structures and equipment can be released for unrestricted access and conventional demolition, i.e., "Greenfield." "This activity facilitates surface decontamination and subsequent verification surveys required prior to obtaining release for demolition. Surface soil, sub-surface media and groundwater will meet the unrestricted use criteria in 10 CFR 20.1402. Underground piping (or similar items) and associated soil will be removed as necessary to meet license termination criteria." (11)

Issue, #2: How much water will be required to reduce radiation levels until residual levels indicate that the structures and equipment can be released for unrestricted access. Who will analyze and monitor water chemistry, where will effluent discharge monitors be located, who and how often will water temperatures be monitored during discharges into the Susquehanna River, and what is the net water loss?

The groundwater protection program currently exists at TMl-1 in accordance with the Nuclear Energy Institute ("NEI)" protocols. This is an industry guidance guardrail, not a government a standard. There is no regular well sampling, and tritium plume pathways are left undetected and unmonitored.

This program is directed by procedures and will continue during decommissioning. Exelon will also continue to maintain the existing radiological decommissioning records program required by 10 CFR 50.75(g). The program is not directed by procedures that factor aggressive decontamination and decommissioning activities.

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11 Three Mile Island Nuclear Station, Unit 1 Post-Shutdown Decommissioning Activities Report p. 14).

According to Exelon, neither the monitoring results of the groundwater protection program nor events noted in 10 CFR 50.75(g) reports indicate the presence of long-lived radionuclides in concentrations sufficient to preclude unrestricted release under 10 CFR 20.1402, "Radiological criteria for unrestricted use." These are cursory programs with spot checks and unchanged monitored locations. (2.2.6, Groundwater Protection and Radiological Decommissioning Records Program. However, significant amounts of tritium has leaked and spilled under Three Mile Island dating back to 1982. (12).

12

• Early 1982: Three thousand (3,000) gallons of radioactive tritium leaked into the groundwater from the borated water storage tank. The leak occurred because work was done without an engineering review. (Congressional Investigation, April 26, 1983).

January 9 & 19, 1999 : Elevated tritium levels and potential leaks from the waste evaporator condensate storage tank for the months of January, February and March, 19998 were reported. (Nuclear Regulatory Commission, Inspection Report 50-289/99-01).

• June 27, 2006: TMI dug up and fixed leaks from the condensate storage tank. The leak followed telephone conduit and flooding. Exelon sampled the water and found tritium. They pumped all the water out of the man ways and dumped it to their industrial waste treatment system which eventually goes to the river. TMI was unaware of the storage tank leak, how much, or for how long. (Nuclear Regulatory Commission)

• November 2006: Radioactively contaminated water leaked into the ground from a broken deicing line on the condensate storage tank. (Nuclear Regulatory Commission),

• July 25, 2012: Chemistry technicians at TMI said they found a slightly elevated level of tritium in one monitoring well on the site near the plant. (Exelon Corporation).

Issue, #3: Please produce the report and supporting materials referenced on p. 17, and determine how the operational plan will detect more intense radioactivity.

Issue, #4: Exelon must define, qualify, and quantify the terms "trivial water use" and how levels will be reduced "substantially." Does substantial and reduce have values?

Issue, #5: How much water will be required in aggregate at TMI-1, who will analyze and monitor water chemistry, where will effluent discharge monitors be located, who and how often will water temperatures be monitored during discharges into the Susquehanna River, and what is the net water loss?

Overall water quality will be impacted by site -specific decommissioning activities, and not generic markers used by Exelon. Ground water and surface water quality will be impacted by fuel removal, stabilization, large component removal, decontamination and dismantlement, and structure dismantlement. With respect to groundwater, the GEIS noted that demolishing concrete structures and storing rubble on site could result in changes (higher alkalinity) in local water chemistry, but the non-radiological effects of such changes on water quality would be non-detectable offsite at all nuclear power plants. " (5.1.3, p. 23). These internal structures will be embrtittled and irradiated.

Exleon's analyses submitted to the NRC were generic, and not site-specific. This is the danger when you try to turn a radioactive lemon into a radioactive orange. In Section 4.3.3 of the GEIS, the NRC concluded "generically that for all facilities, decommissioning impacts to surface and

groundwater quality would be small. According to Exelon, there is nothing about TMl-1's design, location, configuration, operating history, or decommissioning plans that would alter or contradict this generic conclusion and Exelon would comply with regulatory and permit requirements to protect surface water and groundwater resources, Exelon has determined that impacts of decommissioning on water quality bounded by the analysis in the GEIS." (5.1.3. pp. 23-24).

The Petitioners point out that every aspect of the Three Mile Island is unique, and the decontamination and decommissioning for Three Mile Island , like the defueling of TMI-2 is fraught with danger and uncertainty, and is a novel and unique undertaking. Three Mile Island is not generic - "apples to apples" plant taken off the shelf at nuclear Wal Mart.

The nuclear generation stations used a flawed and unique design. Babcock & Wilcox Pressurized Water Reactors are n longer used, and the TMI sued the plaint's designer for "gross negligence." Three Mile Island located in a unique ecosystem. TMI is in the lower Susquehanna River which empties into the Chesapeake Bay. TMI's unique configuration and vulnerable;e. It is one of the last nuclear plants that exclusively uses wet spent fuel storage. In addition, vast portions of TMI-2's basement is uninhabitable. TMI's and unique operating history included a loss of coolant accident, core meltdown, and the Unit-2 containment building which has been soaked in radiation for 42 years. Exelon and its successor as well as TMI-2 Solutions, should not be accorded the "benefit of the doubt" , and are not accorded a magical nuclear wand to speculate, to extrapolate backwards, and to give generic clearance to cleaning up Three Mile Island.

Issue, #6: Request site-specific calculations based on actual activities, not an average, mean or median to calculate water use.

Issue, #7: How much aggregate water will be required for the decontamination and decommissioning of TMI-1 , who will analyze and monitor water chemistry, where will effluent discharge monitors be located, who and how often will water temperatures be monitored during discharges into the Susquehanna River, and what is the net water loss?

III. Three Mile Island Unit-2: Post Defueling Monitored Storage.

On March 28, 1979, Three Mile Island Unit-2 experienced a loss of coolant accident ("LOCA"). The steam generator boiled dry, resulting in the reduction of primary-to- secondary heat exchange. This caused an increase in the primary coolant temperature, creating a surge into the pressurizer, and an increase in system pressure. The pilot operated relief valve ("PORV") opened to relieve the pressure, but failed to close when the pressure decreased. The reactor coolant pumps were turned off and a core heat-up began as the water level decreased to uncover the top of the core. The melting temperature of the zircaloy fuel cladding was exceeded, resulting in relocation of the molten zircaloy and some liquefied fuel to the lower core regions, solidifying near the coolant interface. The majority of the molten material flowed down through the region of the southeastern assemblies and into the core bypass region.

On November 6, 1984, research conducted by the Department of Energy on reactor damage during the accident, indicated temperatures may have reached in excess of 4,800 degrees. In October 1985, removal of damaged fuel from TMI-2 began. Further spread of the debris also occurred as part of the post-accident water processing cleanup activities. The current long- term management condition is termed Post-Defueling Monitored Storage.

"Substantial contaminated areas still exist under the PDMS, as well as trace quantities of spent nuclear fuel ("SNF"). Several cubicles in the auxiliary and fuel handling buildings remain locked, and the basement of the reactor building has been uninhabitable since the accident...A summary of the quantity and suspected location of the remaining fuel debris is provided in Tables 1.1 through 1.3. (13)

The facts on the ground concerning the "unique condition" of TMI-2 is indisputable, and in the initial PEIS in 1981. The Applicant dismisses, ignores, and plays down: 1) TMI-2 is treacherous terrain inhabited by numerous radioactive hot spots; 2) The Applicants are "bound," dependent on past studies without the benefit of an in-depth, site survey;
3) The lack of contemporary, dedicated site studies can not be supplanted by recycled TLG decommissioning estimates ; and, 4) TMI-2 Solutions, like all that came before, will encounter unforeseen conditions that could overwhelm, impede, and delay the cleanup.

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13 TLG Services,Inc., Three Mile Island Unit 2, Document F07-1476-002, "Decommissioning Cost Analysis," Section 1, p. 3).

The PEIS in October 1984 identified the value of onsite surveys, and the miscalculation in dose estimates that have plagued the cleanup from its earliest stages.

> All options for the TMI-2 cleanup evaluated in this supplement involve occupational radiation dose higher than predicted more than three years ago [1981] in the PEIS. The basis for these revised estimates is increased knowledge of the condition inside the reactor building and of the effectiveness of decontamination and does reduction efforts. (14)

Flash forward thirty-seven years, and the Applicant has to be reminded of the uncertainty involved with cleaning up TMI-2. The Department of Environmental Protection describes the obvious: TMI-2 is a "unique" and challenging site unlike any comparable plant decommissioned in America.

There are significant areas in the plant with unknown radiological conditions related to the TMI Unit-2 accident. External gamma radiation measurements are dated or involve limited observation times and remtote equipment due to high radiation levels: Secretary, Patrick McDonnell advised Kristine L. Svinicki, former Chairman of the U.S. Nuclear Regulatory Commission:

> Despite the numerous entries into the containment building to remove damaged nuclear fuel in the 1980s, there are significant areas in the plant with unknown radiological conditions related to the TMI Unit 2 accident. Specifically, external gamma radiation measures may have been made with limited stay times or remote survey instruments, however, the current detailed surface contamination levels of Cs-137, Sr-90 or H-3 (tritium) are not known.

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14 Secretary, Patrick McDonnell letter to Kristine L. Svinicki, former Chairman of the U.S. Nuclear Regulatory Commission, April 6, 2020.

As part of the application, the Applicant should make known to the Susquehanna River Basin Commission any contamination that was covered by clean concrete or sealant during this recovery period. This concern also relates to any radioactive contamination (15) that has migrated into the concrete volume or other surface material. (16)

Moreover, the "apples to apples" argument the Applicant makes comparing TMI to normal operating plants is at the core of their revisionist argument. None of the projects that the Applicant offered are similar to TMI-2. Three Mile Island is not Big Rock, Ft. Calhoun, or Zion. This is the site of the nation's worst commercial nuclear accident. This community has endured the impacts of offsite radiation releases for forty-one years, despite the industry and NRC's assertion that a TMI-type accident was "non-credible."

The Applicant continues to create an "apples to apples approach" and fails to recognize the unique status of TMI-2. The Applicant, a limited liability corporation, does not acknowledge that de-fueling was accompanied by funding provided by rate payers and taxpayers (who have no ownership or voting rights) since there was no decommissioning fund at the time of the TMI-2 Loss of Coolant Accident.

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15 U.S. NRC, NUREG-0683, Supplement 1, Final Report. PEIS, Final Supplement Dealing with Occupational Radiation Dose, October, 1984, p.1, Table, 2.10.

16 PEIS, "2.6., Analysis of Current Cleanup Plan and Alternatives," October, 1984, p. 2.32.

As such, the only precedents established to date are perennial underfunding estimates of the cleanup of TMI-2. and chronic postponements based on the licensee's best guestimates. TMI-2 Solutions is the latest actor to appear on the cleanup stage looking to profit at the expense of rate payers. The four financial, back-up instruments proffered by the Applicant are unaudited, unavailable, and undetermined, and are actually phased out as the decommissioning activities progress. (17)

Numerous site-specific issues are layered on top of the already general and vague water use proposal to decommission Three Mile Island Unit -2:

Issue, #8: How much aggregate water will be required to cleanup, decontaminate, and decommission TMI-2, who will analyze and monitor water chemistry, where will effluent discharge monitors be located, who an how often will water temperatures be monitored during discharges into the Susquehanna River, and what is the net water loss?

Issue, #9: How much water will be required for TMI-2 reduce radiation levels until residual levels indicate that the structures and equipment can be released for unrestricted access and conventional demolition?

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17 "Until the completion of Phase 1, the first four instruments will provide up to $100 million of additional financial assurance to support. After completion of Phase 1, certain of these instruments will remain in effect, to provide additional :financial assurance for TMI-2, decommissioning through the completion of Phase 2. ("Application for Order Approving License Transfer and Conforming License Amendments, GPU NUclear, Inc. and TMI-2 Solutions, LLC, November 12, 2019).

Issue, #10: How much water will be required, who will analyze and monitor water chemistry, where will effluent discharge monitors be located, who and how often will water temperatures be monitored during discharges into the Susquehanna River, and what is the net water loss?

Re: Groundwater Detection Program.

Issue, #11: Please produce the report used to determine how the operational plan will detect more intense radioactivity.

Re: Groundwater Detection Program and Site-Specific Data.

Issues, #12: How much water will be required, who will analyze and monitor water chemistry, where will effluent discharge monitors be located, and who an how often will water temperatures be monitored during discharges into the Susquehanna River, and what is the net water loss?

Re: Site-Specific data.

Issue, #13: Request site-specific calculations based on actual activities, and not an average, mean or median to calculate water use.

Re: Generic Clearance

Issues, #14: How will TMI-2 Solutions return the site to Greenfield? (18)

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18 Significant radioactive contamination exists throughout the TMI-2 reactor building. This contamination is due to fission products (90 Sr and 137 Cs in particular) released from the failed fuel. The radiation levels are not expected to decrease significantly from current levels due to the long half lives of these elements.

Re: Generic Clearance.

Issue, #14: How much aggregate water will be required for the decontamination and decommissioning of TMI-2, who will analyze and monitor water chemistry, where will effluent discharge monitors be located, and who an how often will water temperatures be monitored during discharges into the Susquehanna River, and what is the net water loss? (19)

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19 The initial and only National Pollutant Discharge Elimination System ("NPDES") permit issued in 1977 was explicitly referred to as an "interim agreement. Based on publicly available submissions, TMI-2 did not submit Clean Water Act, Section 401 Certification documents.

This document was not submitted as part of the Application from EnergySolutions and GPU Nuclear, Order Approving and Conforming License Amendments, Three Mile Island Unit, NRC Docket, 50-320, November 12, 2019. Those documents were also addressed and shared with the DEP. The TMI-2 license transfer application purportedly covered environmental compliance under "Environmental Laws" and "Environmental Matters under 4.9." In addition,under Schedule 4.19.1, there was no discussion of the Clean Water Act, Section 401.

IV. Concerns and Issues with the SRBC Application.

Exhibit, #3.

Exhibit, #3.

January 5, 2010

SUSQUEHANNA RIVER BASIN COMMISSION

In the Matter of	)
RE: Bell Bend Nuclear Power Plant	)
Application for Groundwater Withdrawal	)
Application for Consumptive Use	)
BNP-2009-073	)

EXPERT WITNESS REPORT OF ARNOLD GUNDERSEN REGARDING CONSUMPTIVE WATER USE OF THE SUSQUEHANNA RIVER BY THE PROPOSED PPL BELL BEND NUCLEAR POWER PLANT

I, Arnold Gundersen, declare as follows:

1. My name is Arnold Gundersen. I am sui juris. I am over the age of 18-years-old.

2. Eric J. Epstein, a resident of 4100 Hillsdale Road, Harrisburg, PA 17112, and a PPL ratepayer and shareholder, has retained me as an expert witness. I have been asked to examine what alternative methods may be available and could be applied by PPL Bell Bend, LLC ("PPL" or "Applicant) for cooling the steam that is generated by the proposed Bell Bend plant in lieu of withdrawing and discharging significant quantities of water directly into the Susquehanna River. If any alternative methods are available, I have also been asked to discuss those alternatives so that the Susquehanna River Basin Commission (SRBC) will have the information necessary to complete its assessment.

3. I earned my Bachelor's Degree in Nuclear Engineering from Rensselaer Polytechnic Institute (RPI) cum laude. I earned my Master's Degree in Nuclear Engineering from RPI via an Atomic Energy Commission Fellowship. Cooling tower operation and cooling tower plume theory were my area of study for my Master's Degree.

4. I began my career as a reactor operator and instructor in 1971 and progressed to the position of Senior Vice President for a nuclear licensee prior to becoming a nuclear engineering consultant and expert witness. My Curriculum Vitae is Attachment 1.

5. I have qualified as an expert witness before the Nuclear Regulatory Commission (NRC) Atomic Safety and Licensing Board (ASLB) and Advisory Committee on Reactor Safeguards (ACRS), in Federal Court, the State of Vermont Public Service Board, the State of Vermont Environmental Court, and the Florida Public Service Commission.

6. I am an author of the first edition of the Department of Energy (DOE) Decommissioning Handbook.

7. I have more than 38-years of professional nuclear experience *including and not limited to*: Cooling Tower Operation, Cooling Tower Plumes, Consumptive Water Loss, Nuclear Plant Operation, Nuclear Management, Nuclear Safety Assessments, Reliability Engineering, In-service Inspection, Criticality Analysis, Licensing, Engineering Management, Thermohydraulics, Radioactive Waste Processes, Decommissioning, Waste Disposal, Structural Engineering Assessments, Nuclear Fuel Rack Design and Manufacturing, Nuclear Equipment Design and Manufacturing, Prudency Defense, Employee Awareness Programs, Public Relations, Contract Administration, Technical Patents, Archival Storage and Document Control, Source Term Reconstruction, Dose Assessment, Whistleblower Protection, and NRC Regulations and Enforcement.

Introduction

8. My declaration is intended to alert the Susquehanna River Basin Commission (SRBC) to significant problems in consumptive water use of the Susquehanna River if the proposed PPL Bell Bend nuclear plant is built as designed and allowed to use the Susquehanna River as its primary resource for *make-up* water for cooling.

9. Specifically, PPL has filed an application to build a 1,600 MWe Evolutionary Power Reactor (EPR) designed by AREVA named Bell Bend because of its location on the

Bell Bend of the Susquehanna River. In my professional opinion, the Bell Bend Combined License Application (COLA)[1], as filed with the U.S. Nuclear Regulatory Commission (NRC), has significant deficiencies in its analysis resulting in serious unresolved issues with consumptive water use that will negatively impact the health and vitality of the Susquehanna River Watershed and the Chesapeake Bay Watershed.

10. If completed, the proposed PPL Bell Bend nuclear power plant will be one of the largest nuclear reactors in the world. Due to its sheer size and because it also has a lower thermodynamic efficiency (discussed in detail below), Bell Bend will draw an inordinately large amount of water from the Susquehanna River in order to cool the reactor. The amount of water anticipated for use by the PPL proposed Bell Bend nuclear power plant is detailed in a recent report written by Normandeau Associates, paid for by PPL, and submitted to the Susquehanna River Basin Commission.

11. In its November 2009 report, entitled, *Instream Flow Study Plan To Assess The Effects Of Consumptive Use Of Water On Fish Habitat At The Bell Bend Project*, Normandeau Associates said,

> "November 2009 The Bell Bend Nuclear Power Plant (BBNPP) proposed by PPL is estimated to consumptively use up to 43 cubic feet per second (cfs) or 28 million gallons per day (mgd) of water from the Susquehanna River. Up to approximately 64 cfs or 41 mgd will be withdrawn from an intake located about 300 ft downstream of the Susquehanna Steam Electric Station (SSES) intake structure (Figure 1-1). Water not consumed will be returned to the river via a submerged discharge diffuser approximately 680 ft downstream of the BBNPP

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[1] **Combined license (COL)**
By issuing a combined license (COL), the U.S. Nuclear Regulatory Commission (NRC) authorizes the licensee to construct and (with specified conditions) operate a nuclear power plant at a specific site, in accordance with established laws and regulations. A COL is valid for 40 years from the date of the Commission finding, under Title 10, Section 52.103 (g), of the *Code of Federal Regulations* [10 CFR 52.103(g)], that the acceptance criteria in the combined license are met. A COL can be renewed for an additional 20 years.
In a COL application [COLA], the NRC staff reviews the applicant's qualifications, design safety, environmental impacts, operational programs, site safety, and verification of construction with ITAAC. The staff conducts its review in accordance with the Atomic Energy Act, NRC regulations, and the National Environmental Policy Act. All stakeholders (including the public) are given notice as to how and when they may participate in the regulatory process, which may include participating in public meetings and opportunities to request a hearing on the issuance of a COL *http://www.nrc.gov/reactors/new-reactors/col.html*

> intake. PPL has applied to the Susquehanna River Basin Commission (SRBC) for approval to withdraw water from the river at BBNPP and to use some of this water consumptively. In its application to SRBC, PPL has requested approval for consumptive use of up to 31 mgd as a measure of conservatism and to account for variability within the range of monitoring accuracy required by SRBC."[2]

12. As a result, the PPL proposed Bell Bend nuclear power plant will withdraw at least 15,000,000,000 (15 billion) gallons of water from the Susquehanna River every year.

13. Consequently, each year the 4,000,000,000 (4 billion) gallons of water that will be returned to the river will have been heated and will contain additional chemical contaminants discussed below.

14. The difference between what is withdrawn from and what is returned to the Susquehanna River each year will be *consumed* by the PPL proposed Bell Bend nuclear power plant, and as a result, this consumptive use of water amounts to 11,000,000,000 (11 billion) gallons per year.

15. The 11,000,000,000 (11 billion) gallons of water withdrawn each year from the Susquehanna River will be emitted as water vapor from the proposed cooling towers.

16. It is hard to visualize exactly how much 11,000,000,000 (11 billion) gallons of water per year would be. To put the *consumed* water into a visual perspective, the 11 billion gallons of water would fill the equivalent of 50-football fields 500-hundred feet high with river water.

17. Subsequently, in addition to the environmental burden of 4 billion gallons of heated and chemically contaminated water that will be dumped into the River each year, the Susquehanna River Basin and the Chesapeake Bay will face an enormous yearly consumption of Susquehanna River Water that will be withdrawn and never returned.

18. According to the Susquehanna River Basin Commission's website, the mission of the SRBC

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[2] Page 1, *Instream Flow Study Plan To Assess The Effects Of Consumptive Use Of Water On Fish Habitat At The Bell Bend Project*, November 2009

> "...is to enhance public welfare through comprehensive planning, water supply allocation, and management of the water resources of the Susquehanna River Basin. To accomplish this mission, the SRBC works to: reduce damages caused by floods; provide for the reasonable and sustained development and use of surface and ground water for municipal, agricultural, recreational, commercial and industrial purposes; protect and restore fisheries, wetlands and aquatic habitat; protect water quality and instream uses; and ensure future availability of flows to the Chesapeake Bay. The SRBC is uniquely qualified to carry out this mission. As a federal-interstate compact commission, its focus is defined by the natural boundaries of the river basin rather than the political boundaries of the member states. As such, the SRBC serves as a forum to provide coordinated management, promote communication among the members, and resolve water resource issues and controversies within the basin."

19. Moreover, the Susquehanna River Basin Commission has joined with other watershed commissions to form the Interstate Council on Water Policy and is a Chesapeake Bay Partner Community "committed to protecting water quality, the bay, and its many tributaries."

20. Since the Susquehanna River currently provides half of the fresh water that enters the Chesapeake Bay, I believe that the intended withdrawal *each day* of as much as 31,000,000 (31 million) gallons of the Susquehanna River's flow by the proposed PPL Bell Bend nuclear power plant will have a significant impact upon the downstream ecology that is not adequately addressed in the current application or appropriately reflected in the Susquehanna River Basin Commission's fee structure.

21. Consumptive water use is defined as "any use that permanently removes water from a watershed or a confined aquifer from which it is withdrawn by activities that result in substantial evaporation and evapotranspiration." Industrial cooling operations, like those intended for the proposed PPL Bell Bend nuclear power plant, are some of the activities that often result in substantial evaporation and evapotranspiration. http://www.njfb.org/waterquality/glossary.htm

22. A nuclear power plant like the PPL proposed Bell Bend unit uses steam created from water heated by the nuclear reactor to produce electricity. Any power plant, nuclear, coal or oil, that uses steam to turn a turbine that then creates electricity like the

proposed PPL Bell Bend nuclear power plant will do is governed by the laws of thermodynamics. Furthermore, according to the laws of thermodynamics, a physics rule known as the *Carnot cycle*[3] governs the maximum theoretical efficiency of these steam-generated turbine power plants.

23. In lay terms, the Carnot cycle simply means that no power plant is theoretically capable of converting one hundred percent of the heat it produces as steam into electricity. The maximum efficiency of a power plant like the PPL proposed Bell Bend Unit is capped by the difference between two key parameters: the high temperature of the steam (heat source) and the low temperature of the *heat sink*. The PPL Bell Bend nuclear power plant, like most current power plants located on rivers, would use as its heat sink the process of water evaporation in its cooling tower via water withdrawn from the Susquehanna River.

The Carnot Cycle

24. Whether a power plant operates with coal, oil, gas, or nuclear power as the PPL proposed Bell Bend Unit does, each method heats water in order to create steam. In turn the steam is used to turn a turbine and create electricity. By whatever method the steam is created, that is called the "heat source". After that steam turns the turbine, it is cooled, condensed back into water and returned back to the boiler or nuclear reactor from where was originally drawn.

25. This process of creating steam, turning a turbine, condensing the steam and returning it to a boiler or nuclear reactor is called the Carnot cycle. In a Carnot cycle, there must be a *heat source* to create the steam and a *heat sink* to cool the steam back into water. The *heat source* may be oil, coal, wood, gas or nuclear fuel, and the *heat sink* is always either water or air or a combination of both.

26. While all power plants may create heated steam through different *heat sources*, every power plant condenses its steam in a device called a condenser. Even though

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[3] **Carnot cycle** – the most efficient thermal cycle possible, consisting of four reversible processes, two isothermal and two adiabatic. *Jones and Childers Glossary,* http://www.mhhe.com/physsci/physical/jones/student/olc/student_glossary.mhtml

each condenser varies in shape and size, each condenser fulfills the same function: that is, condensers take in steam from a *heat source* and condense it back to water. This cooled steam now becomes water that is called *condensate*. After the cooled steam becomes condensate, it is pumped back to the *heat source* to be heated again. This repeating loop is called the *steam cycle*.

27. In order to turn steam back into condensate, condensers are compartmentalized to separate the heated steam from the *heat source* with a physically separate second loop that is called the *heat sink*. This second loop is filled with either water or air that is the applied cooling mechanism. The heat that leaves a condenser and migrates to the *heat sink* is called *waste heat*.

28. Nuclear plants are inherently less efficient than oil, natural gas, and coal fired power plants because of the Carnot cycle. On a per megawatt basis, nuclear plants also release more waste heat per megawatt than coal, oil, or natural gas fired power plants. The hotter the heat source can be made, the higher the Carnot efficiency. Since both coal and natural gas create higher temperatures by which to create steam than nuclear plants, coal and natural gas plants have a higher Carnot efficiency.

29. Thus, for a nuclear power plant like the PPL proposed Bell Bend unit, more waste heat will be released because it is more inherently less efficient than either coal or natural gas.

30. Additionally, because the PPL proposed Bell Bend nuclear power plant would be the largest size nuclear power plant yet constructed, its sheer size will also increase the waste heat sent to the *heat sink*.

Various Types of Heat Sinks

31. When water is plentiful at nuclear power plants in ocean locations, the steam is passed on the outside of the tubes within the condenser while ocean water passes through the inside of tubes on the other side of the condenser. This is called once through cooling and the ocean is quite literally the heat sink. The advantage of once through cooling is that it makes the nuclear power plants rather inexpensive to build

and operate in comparison to other nuclear power plants that do not have access to such an abundant and infinite water supply. Once through cooling of the condenser has become increasingly rare because the methodology of using ocean or river water to cool the condenser makes the river or ocean too warm thereby killing various aquatic organisms and negatively impacting the ecosystem.

32. River flow is limited and power plant output and *heat sink* demand has increased dramatically with these much larger reactors, so once through cooling is rarely used in inland locations. Due to its large size and inherently inefficient cooling methodology, the proposed PPL Bell Bend nuclear power plant cannot use the Susquehanna River for once through cooling of its condenser. If constructed, the proposed Bell Bend nuclear plant will send all of its waste heat into the air via some type of cooling tower, because the river flow is simply too low to support the consideration of using a once through condenser.

33. Therefore, some form of cooling tower must be relied upon to help cool the steam inside the condenser at the PPL proposed Bell Bend nuclear power plant. There are three types of cooling tower designs currently in use by the power generation industry.

33.1. The first cooling tower design is the large hyperbolic, natural draft cooling tower, which has come to symbolize most nuclear power plants. The shape of these hyperbolic cooling towers creates lift in the air and naturally pulls the air across water that is falling inside them.

33.1.1. Some of this water that is withdrawn from a river evaporates causing large vapor clouds to exit from the top of the cooling tower.

33.1.2. The remaining water is then circulated back through the condenser where it again absorbs heat from the heat source.

33.1.3. A side effect of the process of evaporating water and heating the air is that natural draft cooling towers also concentrate any impurities that are in the river water, basically making that water dirtier.

33.1.4. Additionally, these hyperbolic towers create large plumes of water vapor leaving the top of the tower that have adverse visual and environmental effects.

33.2. Mechanical-draft cooling towers cool countless other power plants around the country, including many nuclear power plants. In this application short squat towers are used instead of the large hyperbolic tower, which does not have fans.

33.2.1. Since these short squat towers cannot rely upon the natural shape of the hyperbolic tower to cool the water, large fans are placed above these cooling towers so that the fans actually pull air through each cell.

33.2.2. These mechanical-draft cooling towers are also called forced draft cooling towers and are a modular design with a lower visual profile.

33.2.3. These forced draft cooling towers also withdraw water from a river and release plumes of water vapor out the top and also concentrate contaminants in the remaining water as did their hyperbolic cooling tower cousins.

33.2.4. While they cost less to build than hyperbolic towers, they have an added operational expense because electricity is required to operate the fans.

33.3. The third design for power generation cooling towers does not use any river water to cool the power plant. This design is called dry cooling and requires a different condenser design than that presently designed for PPL proposed Bell Bend nuclear power plant.

33.3.1. Instead of applying water to cool the steam and then cooling that water with either river water or a combination of fans and river water as in a wet cooling tower, this design cools the steam directly with air and utilizes no outside water.

33.3.2. This design is called an *air-cooled condenser.* These *air-cooled condensers* are short and squat, thereby resembling the forced air towers

discussed in the previous section.

34. Because both the hyperbolic tower and the forced draft tower evaporate water, as discussed in detail in the previous section, some river water must still be used to cool the power plant. *Make-up water* is the term used to describe the water used to replace the evaporated water.

35. All hyperbolic or forced-air cooling towers also create dirty water called *blowdown water* that is returned back to the river with contaminants concentrated within it. *Make-up* water is also used to replace *blowdown* water.

36. The dirty water released from the cooling towers back into the Susquehanna River as *blowdown* will be approximately 25% of the amount of water that is withdrawn. For every four gallons the plant withdraws, it sends back one gallon of *blowdown*. The blowdown is a pollutant for three reasons:

36.1. Three out of every four gallons of withdrawn evaporate water (consumptive use water) that will be initially drawn from the Susquehanna River will be returned to the river as blowdown with four times more concentration of pollutants and minerals than when that water was withdrawn.

36.2. In addition to concentrating contaminants and minerals that already existed in the river, the blowdown contains biocides and algaecides used within the cooling towers to prevent them from becoming clogged with mold and mildew.

36.3. Along with chemical contamination and highly concentrated minerals, the dirty blowdown water will be approximately 20 degrees hotter than the river water to which it is being returned.

37. The PPL proposed Bell Bend nuclear power plant will use about 1% of the flow in the Susquehanna River for its *make-up* water due to evaporation.

38. Whereas, in an air-cooled condenser design, the steam that leaves the turbine passes directly to a dry cooling tower thus using no river water. The air-cooled condenser sits at the base of a dry cooling tower.

38.1. This design has the unique advantage of not having a secondary loop of additional river water required to cool the steam.

38.2. In the air-cooled condenser design, steam heat from the power plant passes through a tube directly into the air.

38.3. Also, in the air-cooled condenser design, steam is directly condensed by the air and then sent back into the power plant.

38.4. No intermediate river water is ever used in the air-cooled condenser design.

39. Dry cooling and an air-cooled condenser have several key advantages:

39.1. The first advantage of dry cooling and an air-cooled condenser is that there is no consumption of river water.

39.2. The second advantage is that without dirty water (or blow down) being sent back into the river, contamination to the river is lessened.

39.3. The third advantage is that there is no cloud of hot moist air leaving the tower, so these towers never produce a cloud of water vapor that has so many additional negative meteorological, environmental, and esthetic impacts.

40. While the air-cooled condenser design would offer many significant advantages for the proposed PPL Bell Bend environment and the overall health of the Susquehanna and Chesapeake watershed areas, these air-cooled designs do have two disadvantages for PPL:

40.1. The first drawback to the air-cooled design is that this design lowers the efficiency of the power plant slightly by increasing the backpressure on the turbine thus providing less electricity to generate and less income for the power plant owner. However, for most of the year, when temperatures are lower than 70 degrees, the efficiency of the air-cooled design is quite comparable to other cooling techniques.

40.2. The second disadvantage of the air-cooled design is that, because it is less

effective at removing the heat from steam than wet evaporative cooling, the air-cooled towers are more expensive to operate than either the hyperbolic or forced air-cooling towers.

41. While installing an air-cooled condenser is slightly more expensive than the approach chosen by PPL to use on the Bell Bend project, air cooled condensers would completely eliminate the significant problem of consumptive water use of the Susquehanna River. If PPL equipped its proposed Bell Bend project with air-cooled condensers, then the Susquehanna River Watershed area would not be facing the negative environmental burden of the Bell Bend nuclear power plant's evaporative losses, including:

41.1. A withdrawal of 31 million gallons per day of water of *make-up* water being drawn from the Susquehanna River to cool plant, or

41.2. Any dirty water *(blowdown water)* being returned to the Susquehanna River.

Detailed Discussion of Air Cooled Condensers

42. Air-cooled condensers consist of a modular design, are pre-built, and then are delivered to the site in individual modules. The air-cooled condenser design is even simpler than the current PPL proposed design for the Bell Bend unit.

43. In my review of the PPL design for its Bell Bend cooling towers, the evidence shows that the overall layout of the main steam and condensate system can in fact accommodate an air-cooled condenser. Furthermore, the only limitation an air-cooled condenser may place upon the proposed PPL Bell Bend nuclear power plant is that backpressure on the steam turbine may change slightly as a result of using an air-cooled condenser.

43.1. A slightly different turbine design will also be required to accommodate an air-cooled condenser due to the slight backpressure considerations with a dry cooling system. The additional cost of this turbine redesign and the backpressure considerations are nominal, especially when compared to the overall cost of the unit and the environmental costs of withdrawing 31 million gallons of water out

of the river daily.

43.2. Additionally, the efficiency of the proposed PPL Bell Bend Project will be reduced by no more than 1% from the slightly higher backpressure due to the use of an air-cooled condenser.

43.3. Moreover, with the air-cooled dry towers, when the ambient air temperatures are 70° or less there will be almost no difference in the electric output of the PPL proposed Bell Bend nuclear power plant as compared with the PPL currently designed evaporative towers.

43.4. At present, in the PPL proposed Bell Bend design, the turbine hall has a very large space underneath the turbine reserved for the intended water-cooled condenser. Therefore, removing the very large water-cooled condenser will provide more than enough space for steam lines to exit from the bottom of the turbine to an air-cooled condenser, seemingly without any additional major modifications.

44. While the Bell Bend design would have to be slightly modified to incorporate an air-cooled condenser, since no components have yet been bought, fabricated, or installed, the redesign cost to accommodate an air-cooled condenser is nominal in comparison to the overall cost of the project and compared to the significant and long-term environmental costs of using evaporative cooling towers to withdraw 15 billion gallons of water from the Susquehanna River every year.

45. Moreover, changing to an air-cooled condenser and air-cooled towers will not impact any aspect of the nuclear design that has already been approved by the Nuclear Regulatory Commission.

46. There are dozens of coal and natural gas-fired plants in the U.S. that use air-cooled condensers, and abundant examples of air-cooled condenser applications of similar or larger sized power plants worldwide.

46.1. For example, the largest air-cooled plant in the U.S. is the 1,650 MW Midlothian Energy natural gas combined cycle plant near Dallas, Texas, and the largest coal-fired air-cooled plant in the U.S. is the 330 MW Wyodak plant in Wyoming.

46.2. Worldwide, the largest air-cooled coal-fired plant in the world is the 4,000 MW Matimba power plant in South Africa.

Water Supply and Potential for Drought

47. In addition to water quality and consumptive water use, the Susquehanna River Watershed could be compromised due to drought. According to SRBC's comprehensive plan, SRBC is responsible for:

47.1. Supporting and encouraging "the sustainable use of water for domestic, industrial, municipal, commercial, agricultural, and recreational activities in the basin" by an inventory of available water resources.

47.2. Maintaining "an equitable system for allocating water for various uses, including the protection of instream flows and receiving waters of the Chesapeake Bay".

47.3. Ensuring "sustainability of water sources by improving systems and managing water resources more efficiently".

47.4. Mitigating "drought impacts through coordination and use of drought emergency powers".

48. *If PPL used air-cooled condensers at its proposed Bell Bend nuclear power plant, no water would be drawn from the Susquehanna River.*

48.1. My review of the evidence provided shows that PPL may not have considered the potential for a drought that would compromise the availability of Susquehanna River water in its engineering design of the 1600 MWe Bell Bend unit.

48.2. A modest but illustrious example of the magnitude of water used at nuclear power plant is readily evidenced at the Susquehanna Steam Electric Station (SSES), which is a two-unit nuclear power plant located on the Susquehanna

River very near to the location of the proposed Bell Bend nuclear power plant.

48.2.1. *Every day* SSES loses 14.93 million gallons of water as evaporative cooling tower water vapor from each of its two units.

48.2.2. Each day 11 million gallons of contaminated cooling tower basin *blowdown* water is returned to the Susquehanna River.

48.2.3. *At the present time, SSES takes on average 29.86 million gallons of water per day from the Susquehanna River that is not returned. However,* according to the NRC, once the Extended Power Uprate is fully implemented at the SSES, the plants will withdraw more than double the amount of water, with an upper limit of 65.4 million gallons per day, totaling almost 24 billion gallons of Susquehanna River Water per year.

> "...will withdraw an average of 60.9 gallons per day (mgd) (230 million L/d) of water from the Susquehanna River for cooling tower evaporative losses and other plant needs, with a maximum daily water withdraw estimate of 65.4 mgd (248 million L/d). This represents a 4.5 and 12.2 percent increase, respectively, in intake water withdrawn from the Susquehanna River from the pre-EPU conditions (NRC 2007a). Some of this water would be returned to the river as cooling tower blowdown, with the difference equaling the amount of the consumptive water use by SSES. Consumptive water use due to evaporation and drift of cooling water through the SSES cooling towers is expected to increase from 38 mgd (144 million L/d) to 44 mgd (166 million L/d). Based on the Susquehanna River's annual mean flow rate, an average annual loss of 0.5 percent of river water at the SSES location would result. During low-flow conditions, which usually occur in late August, the average evaporative loss at SSES could approach 1 percent of the river flow (PPL 2006b)."[4]

48.2.4. As currently designed, the proposed single unit Bell Bend station would withdraw an additional 31,000,000 (31 million) gallons per day.

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[4] US NRC, Environmental Impacts of Operation, Draft NUREG-1437, Supplement 35, 4-15, April 2008

49. According to the U.S. Geological Survey,

> "…changes in evaporation and transpiration during a drought depend on the availability of moisture at the onset of a drought and the severity and duration of a drought. Also, weather conditions during a drought commonly include below-normal cloud cover and humidity and above-normal wind speed. **These factors will increase the rate of evaporation from open bodies of water** and from the soil surface, if soil moisture is available." [Emphasis Added]
> http://geochange.er.usgs.gov/sw/changes/natural/et/

50. One of the considerations for review is plant reliability, and the potential for drought would reduce the reliability of the plant during the middle of the summer exactly at the time the area's need is greatest.

50.1. Droughts on the Susquehanna are not merely a theoretical consideration. According to the SRBC Drought Management Information Sheet[5], droughts and low-water flow but have occurred quite recently, with droughts occurring every decade except the 1970s.

> "Like floods, the magnitude of drought events can be categorized based on historical frequency, i.e., 5-year droughts, 10-year droughts, 50-year droughts, etc. (The higher numbers indicate more severe, and less frequent, droughts.) Droughts can affect the entire basin or cause localized water shortages.
>
> Since the beginning of the 1900s, the basin has experienced droughts in every decade except the 1970s. The worst droughts occurred in 1930, 1939 and 1964. During the 1990s through mid-2000s, periodic low flows throughout the basin or in regions resulted in frequent droughts, including in 1991, 1995, 1997, 1998, 1999, 2000, 2002 and 2006."

50.1.1. The 4,500 businesses in the Susquehanna River Basin employ 230,537 people, add $6.8 Billion (Dollars) to the region's economy, and depend upon the water from the Susquehanna River.[6]

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[5] *SRBC Drought Management Information Sheet*, http://www.srbc.net/hydrologic/docs/Drought%20Management%20(5_07).PDF

[6] *Economic Value of Water Resources: Direct Water-Dependent Businesses in the Susquehanna Basin*, Susquehanna River Basin Commission, Revised: November 2006.

50.1.2. Water shortages on the Lower Susquehanna reached critical levels during the summer of 2002, but during the 2002 drought, the Susquehanna Steam Electric Station's (SSES) two nuclear power plants were in fact exempted from water conservation efforts in order to meet the Region's demand for electricity.

50.1.3. During the month of August 2002, 66 of 67 Pennsylvania counties had below normal precipitation levels, while the Susquehanna Steam Electric Station's nuclear plants *did not take any measures or precautions to conserve water.*

50.1.4. The Bell Bend unit proposed by PPL would withdraw an additional 31,000,000 (31 million) gallons per day from the river obviously exacerbating a frequent drought situation in one of the nation's most critical watershed areas already facing many added usage burdens at the same time it is attempting to heal an environmentally challenged and fragile ecosystem.

51. The June 2009 issue of Power Magazine featured an article entitled *Air Cooled Condensers Eliminate Plant Water Use* in which author William Wurtz said,

> "The pragmatic developer may also select dry cooling early in a project because it increases plant siting options and its use can significantly accelerate approval of construction permits because water use issues are taken off the table. Shortening a project schedule by even six months can completely change the economics of a project and easily balance the increased capital cost of dry cooling options.
>
> Dry cooling applications in the U.S. have not been limited to arid regions but have also been specified for plants sited in eastern, northern, and mountain areas where water is typically more abundant…"

52. The evaporative cooling tower approach planned for Bell Bend and for which PPL has applied is a less costly construction alternative. Moreover, by applying SRBC'S current rate structure for water withdrawal, PPL has a financial incentive to use the low cost Susquehanna River water at the proposed Bell Bend unit rather than designing more environmentally compatible alternative.

53. If the full financial cost accounting of the environmental impact of extracting 20 million gallons per day of water from the Susquehanna River were applied to the PPL Bell Bend project, it is doubtful that the construction design for the PPL Bell Bend project would include evaporative cooling towers that feature large consumptive water losses. Realistic environmental cost accounting applied through a more stringent consumptive water use fee schedule would make the air-cooled condenser design a financially desirable alternative.

The Cost of Water

54. Presently, the Susquehanna River Basin Commission sets the rate schedule for water withdrawal from the Susquehanna River. A new schedule of fees was adopted December 17, 2009.

55. According to the newly instituted Application Fee Schedule in effect beginning January 1, 2010 through December 31, 2010:

55.1. PPL would be charged an application fee of $28,650 for up to ten million gallons per day plus $4,875 for every million gallons per day additional usage beyond that withdrawal rate. Because of its enormous withdrawal rates and the low application fee structure, the PPL proposed Bell Bend project will be charged an application fee of less than 3 tenths of one cent (3/10 of 1¢) per gallon for Bell Bend.

55.2. In comparison, smaller users will be charged $4,400 to apply for water withdrawal of 100,000 gallons per day. On a per gallon basis, smaller users will be charged an application fee of more than 4 cents (4¢) per gallon.

55.3. Thus, the Susquehanna River Basin Commission plans to charge small users 10 times more per gallon to apply for withdrawal from the Susquehanna River than it plans to charge PPL its proposed Bell Bend project.

55.4. The environmental impact of a 100,000 (100 Thousand) gallon per day withdrawal pales in comparison to a 31,000,000 (31 million) gallon per day withdrawal proposed by PPL it its COLA for Bell Bend.

55.5. The data reviewed shows that the consumptive water use intended by the PPL proposed Bell Bend project may require significant additional environmental review. The new SRBC fee schedule appears to erroneously encourage the consumptive water use of 31,000,000 (31 million) gallons per day proposed by PPL. Therefore, other users of the river water are effectively subsidizing the PPL Bell Bend application.

56. Furthermore, according to the Susquehanna River Basin Commission's new fee schedule, all users will be charged the same "Consumptive Use Mitigation Fee $0.28 for every 1,000 gallons consumed". The same fee is assessed to users drawing 100 times less water than the PPL proposed Bell Bend project is anticipated to withdraw. Therefore the "Consumptive Use Mitigation Fee" of $0.28, rewards large-scale users thereby encouraging large-scale use and its resulting negative environmental impact upon the River. Moreover, if Bell Bend were allowed to withdraw 31,000,000 (31 million) gallons of water under this fee schedule, then hundreds of other small water users will be precluded water use and access to water rights for the anticipated 60-year life of the PPL proposed Bell Bend nuclear power plant.

57. By choosing low fees for water withdrawal, the Susquehanna River Basin Commission appears to subsidize the consumptive water use anticipated by the PPL Bell Bend project. In turn, this subsidy reduces available water to downstream communities and increases the down stream pressures on the Susquehanna River and the Chesapeake Bay.

58. Before a Joint Meeting of the Senate Environmental Resources & Energy Committee and the Senate Agriculture and Rural Affairs Committee on September 20, 2005, Kathleen A. McGinty, Pennsylvania's former Secretary of the Department of Environmental Protection, submitted testimony entitled *Pennsylvania's Chesapeake Bay Tributary Strategy*[7]. Secretary McGinty said,

> "...a court order directed the federal agency to take action to restore the Chesapeake. Mandatory directives from EPA will come to Pennsylvania and other Bay states in 2010 if sufficient measures are

[7] http://www.depweb.state.pa.us/dep/cwp/view.asp?a=3&q=474519

> not in place by then to restore water quality in the Bay and its tributaries.
>
> More than half of our Commonwealth is within the Chesapeake Bay Watershed, with the Susquehanna River, the Bay's largest tributary, providing roughly half of the total freshwater flow…
>
> Pennsylvania is working with communities, watershed groups, farmers and businesses to develop new tools and put practical solutions on the ground to improve the quality of our waterways. It is imperative that we work aggressively to clean up what is one of our Commonwealth's greatest natural resources. It is true that the work we do at home ultimately serves to help the Bay. But our efforts are about making sure the water in Pennsylvania is safe to drink, healthy enough to sustain aquatic life and abundant in supply to sustain our economy."

59. Reiterating what the Secretary stated, an "abundant supply" of water is important to "sustain our economy". Yet as proposed, the PPL Bell Bend project reduces the River's flow at the same time it introduces more contaminated water back into the Susquehanna River. The PPL intended intensive consumptive water use at Bell Bend and its resulting reduction in water flow in the Susquehanna River seems counterproductive to the goals stated by the Pennsylvania's Secretary of the Department of Environmental Protection, especially when an air-cooled condenser design is available for substitution.

60. Since the Susquehanna River provides half of the fresh water that enters the Chesapeake Bay, the withdrawal of 31,000,000 gallons per day of the River's flow will have a significant impact on the down stream ecology that is not reflected in the SRBC fee structure.

61. The PPL proposed withdrawal of fresh water from the river, while also reintroducing concentrated contaminants back into the river, has the net effect of concentrating the pollutants that move downstream into Chesapeake Bay. Achieving Secretary McGinty's goal "to restore water quality in the Bay and its tributaries" will be nearly impossible if PPL is allowed to have the Bell Bend nuclear plant withdraw such a significant portion of river flow while providing almost no financial remuneration to the SRBC for the use of that water and remediation of the Susquehanna River. A realistic financial cost accounting of the environmental impact of the PPL Bell Bend

project upon the Susquehanna River and Chesapeake Bay Watersheds may help to ascertain how much money will be required to remediate the River.

62. In my opinion, the present design of the PPL Bell Bend nuclear power plant that calls for the withdrawal of huge amounts of water from the Susquehanna will exacerbate downstream problems in the Chesapeake Bay. The problem of such water intensive use would be entirely mitigated by the installation of an air-cooled condenser and air-cooled cooling towers prior to construction.

63. First, if the Susquehanna's flow is used by the PPL proposed Bell Bend nuclear power plant, more significant economic opportunities may be lost. The enormous consumptive water use of the PPL proposed Bell Bend project would limit Pennsylvania's ability to pursue other economic opportunities in the future. Specifically, there may be a need to use river water to extract natural gas in the Marcellus Shale deposits. The extraction and sale of natural gas from the Marcellus Shale will provide significant economic advantages in the form of revenue and employment, but only if adequate river water is available. The Bell Bend COL application will significantly reduce the amount of river water available for any additional projects.

64. Second, I have identified three additional problems with the PPL proposed Bell Bend application to withdraw large amounts of water from the Susquehanna River.

    64.1. It would increase downstream contamination of the Chesapeake,

    64.2. This loss of available water for small businesses would reduce employment opportunities all along the Susquehanna River.

    64.3. It would also limit the possible economic development of the Marcellus Shale that would benefit of the State of Pennsylvania.

65. All of these problems would be completely eliminated by the installation of air-cooled condensers on by PPL before construction begins on its proposed Bell Bend project. These air-cooled condensers are already in use in the electric industry but cannot be retrofitted for use at Bell Bend after the plant has begun construction.

66. The most likely reason that PPL is proposing such a large withdrawal of water from

the Susquehanna River for its Bell Bend nuclear power plant is that the SRBC present fee structure is so low that PPL has no motivation to address the long-term economic and environmental damage that would be mitigated by the installation of air-cooled condensers at Bell Bend.

Conclusion

67. In conclusion, air-cooled condensers could be successfully integrated into the PPL Bell Bend project design and the use of such air-cooled condensers would completely eliminate the need for the PPL Bell Bend nuclear power plants to have such a projected massive consumptive water use from the Susquehanna River.

68. However, the proposal presently in front of the Susquehanna Basin River Commission never discusses this viable alternative. Moreover, it is critical that the substitution of an air-cooled condenser and air-cooled cooling towers receive adequate analysis now, prior to final design and preliminary construction, as it is impossible to adapt the plant to the use of air-cooled condensers after the construction process is initiated.

69. Finally, the *Draft* fee schedule as presently proposed by the Susquehanna River Basin Commission subsidizes huge consumptive water use at great risk to the Susquehanna River Watershed and the Chesapeake Bay Watershed. These two vital watershed communities are already challenged by frequently occurring drought conditions as well as the negative environmental impact of dirty water (*blowdown*) on the Susquehanna River and Chesapeake Bay fragile aquatic ecosystems.

Attachments:

Attachment 1 – Curriculum Vitae

I declare under penalty of perjury that the foregoing is true and correct.

Executed this day, January 5, 2010 at Burlington, Vermont.

1/7/10

Arnold Gundersen, MSNE
Chief Engineer, Fairewinds Associates, Inc

I HEREBY CERTIFY that on this 5th day of January 2010, Arnold Gundersen, resident of Burlington Vermont, who is personally known to me or who produced the following identification, personally appeared before me, and he swore, subscribed, and acknowledged before me that he executed the foregoing as his free act and deed as an expert witness of said case, for the uses and purposes therein mentioned, and that he did take an oath.

In witness whereof, I have hereunto set my hand and seal in the County and State aforesaid.

OFFICIAL NOTARY [illegible], NOTARY PUBLIC
STATE OF VERMONT

MY COMMISSION EXPIRES: Feb 2011

CURRICULUM VITAE
Arnold Gundersen
Chief Engineer, Fairewinds Associates, Inc
December 2009

Education and Training

ME NE	Master of Engineering Nuclear Engineering Rensselaer Polytechnic Institute, 1972 U.S. Atomic Energy Commission Fellowship Thesis: Cooling Tower Plume Rise
BS NE	Bachelor of Science Nuclear Engineering Rensselaer Polytechnic Institute, Cum Laude, 1971 James J. Kerrigan Scholar
RO	Licensed Reactor Operator, U.S. Atomic Energy Commission License # OP-3014

Qualifications – including and not limited to:

- Chief Engineer, Fairewinds Associates, Inc
- Nuclear Engineering, Safety, and Reliability Expert
- Federal and Congressional hearing testimony and Expert Witness testimony
- Former Senior Vice President Nuclear Licensee
- Former Licensed Reactor Operator
- 39-years of nuclear industry experience and oversight
    - Nuclear engineering management assessment and prudency assessment
    - Nuclear power plant licensing and permitting – assessment and review
    - Nuclear safety assessments, source term reconstructions, dose assessments, criticality analysis, and thermohydraulics
    - Contract administration, assessment and review
    - Systems engineering and structural engineering assessments
    - Cooling tower operation, cooling tower plumes, thermal discharge assessment, and consumptive water use
    - Nuclear fuel rack design and manufacturing, nuclear equipment design and manufacturing, and technical patents
    - Radioactive waste processes, storage issue assessment, waste disposal and decommissioning experience
    - Reliability engineering and aging plant management assessments, in-service inspection
    - Employee awareness programs, whistleblower protection, and public communications
    - Quality Assurance (QA) & records

Publications

Co-author — *DOE Decommissioning Handbook, First Edition*, 1981-1982, invited author.

Co-author — *Decommissioning the Vermont Yankee Nuclear Power Plant: An Analysis of Vermont Yankee's Decommissioning Fund and Its Projected Decommissioning Costs*, November 2007, Fairewinds Associates, Inc.

Co-author — *Decommissioning Vermont Yankee – Stage 2 Analysis of the Vermont Yankee Decommissioning Fund – The Decommissioning Fund Gap*, December 2007, Fairewinds

Associates, Inc. Presented to Vermont State Senators and Legislators.

Co-author — *Vermont Yankee Comprehensive Vertical Audit – VYCVA – Recommended Methodology to Thoroughly Assess Reliability and Safety Issues at Entergy Nuclear Vermont Yankee*, January 30, 2008 Testimony to Finance Committee Vermont Senate

Co-author — *Act 189 Public Oversight Panel Report*, March 17, 2009, to the Vermont State Legislature by the Vermont Yankee Public Oversight Panel.

Author — Fairewinds Associates, Inc *First Quarterly Report to the Joint Legislative Committee*, October 19, 2009.

Patents

Energy Absorbing Turbine Missile Shield – U.S. Patent # 4,397,608 – 8/9/1983

Committee Memberships

Vermont Yankee Public Oversight Panel – appointed 2008 by President Pro-Tem Vermont Senate

National Nuclear Safety Network – Founding Board Member

Three Rivers Community College – Nuclear Academic Advisory Board

Founding Member of Connecticut Low Level Radioactive Waste Advisory Committee – 10 years

Founding Member Radiation Safety Committee, NRC Licensee

ANSI N-198, Solid Radioactive Waste Processing Systems

Honors

U.S. Atomic Energy Commission Fellowship, 1972

B.S. Degree, Cum Laude, RPI, 1971, 1st in nuclear engineering class

Tau Beta Pi (Engineering Honor Society), RPI, 1969 – 1 of 5 in sophomore class of 700

James J. Kerrigan Scholar 1967–1971

Teacher of the Year – 2000, Marvelwood School

Publicly commended to U.S. Senate by NRC Chairman, Ivan Selin, in May 1993 – "It is true...everything Mr. Gundersen said was absolutely right; he performed quite a service."

Nuclear Consulting and Expert Witness Testimony

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB)

Declaration of Arnold Gundersen Supporting Supplemental Petition of Intervenors Contention 15: Detroit Edison Cola Lacks Statutorily Required Cohesive QA Program, December 8, 2009.

U.S. NRC Region III Allegation Filed by Missouri Coalition for the Environment

Expert Witness Report entitled: *Comments on the Callaway Special Inspection by NRC Regarding the May 25, 2009 Failure of its Auxiliary Feedwater System,* November 9, 2009.

Vermont State Legislature Joint Fiscal Committee Expert Witness regarding Entergy Nuclear Vermont Yankee

The First Quarterly Report to the Joint Legislative Committee regarding reliability issues at Entergy Nuclear Vermont Yankee, issued October 19, 2009 and oral testimony to the Vermont State Legislature Joint Fiscal Committee.
(http://www.leg.state.vt.us/JFO/Vermont%20Yankee.htm).

Florida Public Service Commission (FPSC)
Gave direct oral testimony to the FPSC in hearings in Tallahassee, FL, September 8 and 10, 2009 in support of Southern Alliance for Clean Energy (SACE) contention of anticipated licensing and construction delays in newly designed Westinghouse AP 1000 reactors proposed by Progress Energy Florida and Florida Power and Light (FPL).

Florida Public Service Commission (FPSC)
NRC announced delays confirming my original testimony to FPSC detailed below. My supplemental testimony alerted FPSC to NRC confirmation of my original testimony regarding licensing and construction delays due to problems with the newly designed Westinghouse AP 1000 reactors in *Supplemental Testimony In Re: Nuclear Plant Cost Recovery Clause By The Southern Alliance For Clean Energy*, FPSC Docket No. 090009-EI, August 12, 2009.

Florida Public Service Commission (FPSC)
Licensing and construction delays due to problems with the newly designed Westinghouse AP 1000 reactors in *Direct Testimony In Re: Nuclear Plant Cost Recovery Clause By The Southern Alliance For Clean Energy*, FPSC Docket No. 090009-EI, July 15, 2009.

Vermont State Legislature Joint Fiscal Committee Expert Witness Oversight Role for Entergy Nuclear Vermont Yankee (ENVY)
Contracted by the Joint Fiscal Committee of the Vermont State Legislature as an expert witness to oversee the compliance of ENVY to reliability issues uncovered during the 2009 legislative session by the Vermont Yankee Public Oversight Panel of which I was appointed a member along with former NRC Commissioner Peter Bradford for one year from July 2008 to 2009. Entergy Nuclear Vermont Yankee (ENVY) is currently under review by Vermont State Legislature to determine if it should receive a Certificate for Public Good (CPG) to extend its operational license for another 20-years. Vermont is the only state in the country that has legislatively created the CPG authorization for a nuclear power plant. Act 160 was passed to ascertain ENVY's ability to run reliably for an additional 20 years. Appointment from July 2009 to May 2010.

U.S. Nuclear Regulatory Commission
Expert Witness Declaration regarding Combined Operating License Application (COLA) at North Anna Unit 3 *Declaration of Arnold Gundersen Supporting Blue Ridge Environmental Defense League's Contentions* (June 26, 2009).

U.S. Nuclear Regulatory Commission
Expert Witness Declaration regarding Through-wall Penetration of Containment Liner and Inspection Techniques of the Containment Liner at Beaver Valley Unit 1 Nuclear Power Plant *Declaration of Arnold Gundersen Supporting Citizen Power's Petition* (May 25, 2009).

U.S. Nuclear Regulatory Commission
Expert Witness Declaration regarding Quality Assurance and Configuration Management at Bellefonte Nuclear Plant *Declaration of Arnold Gundersen Supporting Blue Ridge Environmental Defense League's Contentions in their Petition for Intervention and Request for Hearing*, May 6, 2009.

Pennsylvania Statehouse
Expert Witness Analysis presented in formal presentation at the Pennsylvania Statehouse, March 26, 2009 regarding actual releases from Three Mile Island Nuclear Accident. Presentation may be found at: http://www.tmia.com/march26

Vermont Legislative Testimony and Formal Report for 2009 Legislative Session
As a member of the Vermont Yankee Public Oversight Panel, I spent almost eight months examining the Vermont Yankee Nuclear Power Plant and the legislatively ordered Comprehensive Vertical Audit. Panel submitted Act 189 Public Oversight Panel Report March 17, 2009 and oral testimony to a joint hearing of the Senate Finance and House Natural Resources March 19, 2009. (See: http://www.leg.state.vt.us/JFO/Vermont%20Yankee.htm)

Finestone v FPL (11/2003 to 12/2008) Federal Court
Plaintiffs' Expert Witness for Federal Court Case with Attorney Nancy LaVista, from the firm Lytal, Reiter, Fountain, Clark, Williams, West Palm Beach, FL. This case involved two plaintiffs in cancer cluster of 40 families alleging that illegal radiation releases from nearby nuclear power plant caused children's cancers. Production request, discovery review, preparation of deposition questions and attendance at Defendant's experts for deposition, preparation of expert witness testimony, preparation for Daubert Hearings, ongoing technical oversight, source term reconstruction and appeal to Circuit Court.

U.S. Nuclear Regulatory Commission Advisory Committee Reactor Safeguards (NRC-ACRS)
Expert Witness providing oral testimony regarding Millstone Point Unit 3 (MP3) Containment issues in hearings regarding the Application to Uprate Power at MP3 by Dominion Nuclear, Washington, and DC. (July 8-9, 2008).

Appointed by President Pro-Tem of Vermont Senate to Legislatively Authorized Nuclear Reliability Public Oversight Panel
To oversee Comprehensive Vertical Audit of Entergy Nuclear Vermont Yankee (Act 189) and testify to State Legislature during 2009 session regarding operational reliability of ENVY in relation to its 20-year license extension application. (July 2, 2008 to present).

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB)
Expert Witness providing testimony regarding *Pilgrim Watch's Petition for Contention 1 Underground Pipes* (April 10, 2008).

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB)
Expert Witness supporting *Connecticut Coalition Against Millstone In Its Petition For Leave To Intervene, Request For Hearing, And Contentions Against Dominion Nuclear Connecticut Inc.'s*

Millstone Power Station Unit 3 License Amendment Request For Stretch Power Uprate (March 15, 2008).

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB)
Expert Witness supporting *Pilgrim Watch's Petition For Contention 1: specific to issues regarding the integrity of Pilgrim Nuclear Power Station's underground pipes and the ability of Pilgrim's Aging Management Program to determine their integrity.* (January 26, 2008).

Vermont State House – 2008 Legislative Session

- House Committee on Natural Resources and Energy – Comprehensive Vertical Audit: *Why NRC Recommends a Vertical Audit for Aging Plants Like Entergy Nuclear Vermont Yankee (ENVY)*
- House Committee on Commerce – Decommissioning Testimony

Vermont State Senate – 2008 Legislative Session

- Senate Finance – testimony regarding Entergy Nuclear Vermont Yankee Decommissioning Fund
- Senate Finance – testimony on the necessity for a Comprehensive Vertical Audit (CVA) of Entergy Nuclear Vermont Yankee
- Natural Resources Committee – testimony regarding the placement of high-level nuclear fuel on the banks of the Connecticut River in Vernon, VT

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB)
MOX Limited Appearance Statement to Judges Michael C. Farrar (Chairman), Lawrence G. McDade, and Nicholas G. Trikouros for the "Petitioners": Nuclear Watch South, the Blue Ridge Environmental Defense League, and Nuclear Information & Resource Service in support of *Contention 2: Accidental Release of Radionuclides, requesting a hearing concerning faulty accident consequence assessments made for the MOX plutonium fuel factory proposed for the Savannah River Site.* (September 14, 2007).

Appeal to the Vermont Supreme Court (March 2006 to 2007)
Expert Witness Testimony in support of *New England Coalition's Appeal to the Vermont Supreme Court Concerning: Degraded Reliability at Entergy Nuclear Vermont Yankee as a Result of the Power Uprate.* New England Coalition represented by Attorney Ron Shems of Burlington, VT.

State of Vermont Environmental Court (Docket 89-4-06-vtec 2007)
Expert witness retained by New England Coalition to review Entergy and Vermont Yankee's analysis of alternative methods to reduce the heat discharged by Vermont Yankee into the Connecticut River. Provided Vermont's Environmental Court with analysis of alternative methods systematically applied throughout the nuclear industry to reduce the heat discharged by nuclear power plants into nearby bodies of water and avoid consumptive water use. This report included a review of the condenser and cooling tower modifications.

U.S. Senator Bernie Sanders and Congressman Peter Welch (2007)
Briefed Senator Sanders, Congressman Welch and their staff members regarding technical and engineering issues, reliability and aging management concerns, regulatory compliance, waste storage, and nuclear power reactor safety issues confronting the U.S. nuclear energy industry.

State of Vermont Legislative Testimony to Senate Finance Committee (2006)
Testimony to the Senate Finance Committee regarding Vermont Yankee decommissioning costs, reliability issues, design life of the plant, and emergency planning issues.

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB)
Expert witness retained by New England Coalition to provide Atomic Safety and Licensing Board with an independent analysis of the integrity of the Vermont Yankee Nuclear Power Plant condenser (2006).

U.S. Senators Jeffords and Leahy (2003 to 2005)
Provided the Senators and their staffs with periodic overview regarding technical, reliability, compliance, and safety issues at Entergy Nuclear Vermont Yankee (ENVY).

10CFR 2.206 filed with the Nuclear Regulatory Commission (July 2004)
Filed 10CFR 2.206 petition with NRC requesting confirmation of Vermont Yankee's compliance with General Design Criteria.

State of Vermont Public Service Board (April 2003 to May 2004)
Expert witness retained by New England Coalition to testify to the Public Service Board on the reliability, safety, technical, and financial ramifications of a proposed increase in power (called an uprate) to 120% at Entergy's 31-year-old Vermont Yankee Nuclear Power Plant.

International Nuclear Safety Testimony
Worked for ten days with the President of the Czech Republic (Vaclav Havel) and the Czech Parliament on their energy policy for the 21st century.

Nuclear Regulatory Commission (NRC) Inspector General (IG)
Assisted the NRC Inspector General in investigating illegal gratuities paid to NRC Officials by Nuclear Energy Services (NES) Corporate Officers. In a second investigation, assisted the Inspector General in showing that material false statements (lies) by NES corporate president caused the NRC to overlook important violations by this licensee.

State of Connecticut Legislature
Assisted in the creation of State of Connecticut Whistleblower Protection legal statutes.

Federal Congressional Testimony
Publicly recognized by NRC Chairman, Ivan Selin, in May 1993 in his comments to U.S. Senate, "It is true...everything Mr. Gundersen said was absolutely right; he performed quite a service." Commended by U.S. Senator John Glenn for public testimony to Senator Glenn's NRC Oversight Committee.

PennCentral Litigation
Evaluated NRC license violations and material false statements made by management of this nuclear engineering and materials licensee.

Three Mile Island Litigation
Evaluated unmonitored releases to the environment after accident, including containment breach, letdown system and blowout. Proved releases were 15 times higher than government estimate and subsequent government report.

Western Atlas Litigation
Evaluated neutron exposure to employees and license violations at this nuclear materials licensee.

Commonwealth Edison
In depth review and analysis for Commonwealth Edison to analyze the efficiency and effectiveness of all Commonwealth Edison engineering organizations, which support the operation of all of its nuclear power plants.

Peach Bottom Reactor Litigation
Evaluated extended 28-month outage caused by management breakdown and deteriorating condition of plant.

***Special Remediation Expertise*:**
Director of Engineering, Vice President of Site Engineering, and the Senior Vice President of Engineering at Nuclear Energy Services (NES).

- NES was a nuclear licensee that specialized in dismantlement and remediation of nuclear facilities and nuclear sites. Member of the radiation safety committee for this licensee.
- Department of Energy chose NES to write *DOE Decommissioning Handbook* because NES had a unique breadth and depth of nuclear engineers and nuclear physicists on staff.
- Personally wrote the "Small Bore Piping" chapter of the DOE's first edition Decommissioning Handbook, personnel on my staff authored other sections, and I reviewed the entire Decommissioning Handbook.
- Served on the Connecticut Low Level Radioactive Waste Advisory Committee for 10 years from its inception.
- Managed groups performing analyses on dozens of dismantlement sites to thoroughly remove radioactive material from nuclear plants and their surrounding environment.
- Managed groups assisting in decommissioning the Shippingport nuclear power reactor. Shippingport was the first large nuclear power plant ever decommissioned. The decommissioning of Shippingport included remediation of the site after decommissioning.
- Managed groups conducting site characterizations (preliminary radiation surveys prior to commencement of removal of radiation) at the radioactively contaminated West Valley site in upstate New York.
- Personnel reporting to me assessed dismantlement of the Princeton Avenue Plutonium Lab in New Brunswick, NJ. The lab's dismantlement assessment was stopped when we uncovered extremely toxic and carcinogenic underground radioactive contamination.

- Personnel reporting to me worked on decontaminating radioactive thorium at the Cleveland Avenue nuclear licensee in Ohio. The thorium had been used as an alloy in turbine blades. During that project, previously undetected extremely toxic and carcinogenic radioactive contamination was discovered below ground after an aboveground gamma survey had purported that no residual radiation remained on site.

Teaching and Academic Administration Experience

Rensselaer Polytechnic Institute (RPI) – Advanced Nuclear Reactor Physics Lab
Community College of Vermont – Mathematics Professor – 2007 to present
Burlington High School
Mathematics Teacher – 2001 to June 2008
Physics Teacher – 2004 to 2006
The Marvelwood School – 1996 to 2000
Awarded Teacher of the Year – June 2000
Chairperson: Physics and Math Department
Mathematics and Physics Teacher, Faculty Council Member
Director of Marvelwood Residential Summer School
Director of Residential Life
The Forman School & St. Margaret's School – 1993 to 1995
Physics and Mathematics Teacher, Tennis Coach, Residential Living Faculty Member

Nuclear Engineering 1970 to Present

Vetted as expert witness in nuclear litigation and administrative hearings in federal, international, and state court and to Nuclear Regulatory Commission, including but not limited to: Three Mile Island, US Federal Court, US NRC, NRC ASLB & ACRS, Vermont State Legislature, Vermont State Public Service Board, Florida Public Service Board, Czech Senate, Connecticut State Legislature, Western Atlas Nuclear Litigation, U.S. Senate Nuclear Safety Hearings, Peach Bottom Nuclear Power Plant Litigation, and Office of the Inspector General NRC.

Nuclear Engineering, Safety, and Reliability Expert Witness 1990 to Present

- Fairewinds Associates, Inc – Chief Engineer, 2005 to Present
- Arnold Gundersen, Nuclear Safety Consultant and Energy Advisor, 1995 to 2005
- GMA – 1990 to 1995, including expert witness testimony regarding the accident at Three Mile Island.

Nuclear Energy Services, Division of PCC (Fortune 500 company) 1979 to 1990
Corporate Officer and Senior Vice President - Technical Services
Responsible for overall performance of the company's Inservice Inspection (ASME XI), Quality Assurance (SNTC 1A), and Staff Augmentation Business Units – up to 300 employees at various nuclear sites.

Senior Vice President of Engineering
Responsible for the overall performance of the company's Site Engineering, Boston Design Engineering and Engineered Products Business Units. Integrated the Danbury based, Boston based and site engineering functions to provide products such as fuel racks, nozzle dams, and transfer mechanisms and services such as materials management and procedure development.

Vice President of Engineering Services
Responsible for the overall performance of the company's field engineering, operations engineering, and engineered products services. Integrated the Danbury-based and field-based engineering functions to provide numerous products and services required by nuclear utilities, including patents for engineered products.

General Manager of Field Engineering
Managed and directed NES' multi-disciplined field engineering staff on location at various nuclear plant sites. Site activities included structural analysis, procedure development, technical specifications and training. Have personally applied for and received one patent.

Director of General Engineering
Managed and directed the Danbury based engineering staff. Staff disciplines included structural, nuclear, mechanical and systems engineering. Responsible for assignment of personnel as well as scheduling, cost performance, and technical assessment by staff on assigned projects. This staff provided major engineering support to the company's nuclear waste management, spent fuel storage racks, and engineering consulting programs.

New York State Electric and Gas Corporation (NYSE&G) — 1976 to 1979
Reliability Engineering Supervisor
Organized and supervised reliability engineers to upgrade performance levels on seven operating coal units and one that was under construction. Applied analytical techniques and good engineering judgments to improve capacity factors by reducing mean time to repair and by increasing mean time between failures.

Lead Power Systems Engineer
Supervised the preparation of proposals, bid evaluation, negotiation and administration of contracts for two 1300 MW NSSS Units including nuclear fuel, and solid-state control rooms. Represented corporation at numerous public forums including TV and radio on sensitive utility issues. Responsible for all nuclear and BOP portions of a PSAR, Environmental Report, and Early Site Review.

Northeast Utilities Service Corporation (NU) — 1972 to 1976
Engineer
Nuclear Engineer assigned to Millstone Unit 2 during start-up phase. Lead the high velocity flush and chemical cleaning of condensate and feedwater systems and obtained discharge permit for chemicals. Developed Quality Assurance Category 1 Material, Equipment and Parts List. Modified fuel pool cooling system at Connecticut Yankee, steam generator blowdown system and diesel generator lube oil system for Millstone. Evaluated Technical Specification Change Requests.

Associate Engineer
Nuclear Engineer assigned to Montague Units 1 & 2. Interface Engineer with NSSS vendor, performed containment leak rate analysis, assisted in preparation of PSAR and performed radiological health analysis of plant. Performed environmental radiation survey of Connecticut Yankee. Performed chloride intrusion transient analysis for Millstone Unit 1 feedwater system. Prepared Millstone Unit 1 off-gas modification licensing document and Environmental Report Amendments 1 & 2.

Rensselaer Polytechnic Institute (RPI) — 1971 to 1972
Critical Facility Reactor Operator, Instructor
Licensed AEC Reactor Operator instructing students and utility reactor operator trainees in start-up through full power operation of a reactor.

Public Service Electric and Gas (PSE&G) — 1970
Assistant Engineer
Performed shielding design of radwaste and auxiliary buildings for Newbold Island Units 1 & 2, including development of computer codes.

Public Service, Cultural, and Community Activities

2005 to Present – Public presentations and panel discussions on nuclear safety and reliability at University of Vermont, NRC hearings, Town and City Select Boards, Legal Panels, Television, and Radio

2007-2008 – Created Concept of Solar Panels on Burlington High School; worked with Burlington Electric Department and Burlington Board of Education Technology Committee on Grant for installation of solar collectors for Burlington Electric peak summer use

Vermont State Legislature – Ongoing Public Testimony to Legislative Committees

Certified Foster Parent State of Vermont – 2004 to 2007

Mentoring former students – 2000 to present – college application and employment application questions and encouragement

Tutoring Refugee Students – 2002 to 2006 – Lost Boys of the Sudan and others from educationally disadvantaged immigrant groups

Designed and Taught Special High School Math Course for ESOL Students – 2007 to 2008

Featured Nuclear Safety and Reliability Expert (1990 to present) for Television, Newspaper, Radio, & Internet
Including, and not limited to: CNN (Earth Matters), NECN, WPTZ VT, WTNH, VPTV, WCAX, Cable Channel 17, The Crusaders, Front Page, Mark Johnson Show, Steve West Show, Anthony Polina Show, WKVT, WDEV, WVPR, WZBG CT, Seven Days, AP News Service, Houston Chronicle, Christian Science Monitor, New York Times, Brattleboro Reformer, Rutland Herald, Times-Argus, Burlington Free Press, Litchfield County Times, The News Times, The New Milford Times, Hartford Current, New London Day, evacuationplans.org, Vermont Daily Briefing, Green Mountain Daily, and numerous other national and international blogs

NNSN – National Nuclear Safety Network, Founding Advisory Board Member, meetings with and testimony to the Nuclear Regulatory Commission Inspector General (NRC IG)

Berkshire School Parents Association, Co-Founder

Berkshire School Annual Appeal, Co-Chair

Sunday School Teacher, Christ Episcopal Church, Roxbury, CT

Washington Montessori School Parents Association Member
Episcopal Marriage Encounter National Presenting Team with wife Margaret
Provided weekend communication and dialogue workshops weekend retreats/seminars
Connecticut Episcopal Marriage Encounter Administrative Team – 5 years
Northeast Utilities Representative Conducting Public Lectures on Nuclear Safety Issues

Personal and Family Data

Born January 4, 1949, Elizabeth, NJ
Married in 1979 to Margaret Gundersen, certified paralegal and founder of Fairewinds Associates, Inc, www.fairewinds.com
Children:
Elida Gundersen, age 27, paramedic & crew chief, Charleston County EMS, Charleston, SC
Eric Gundersen, age 30, founder Development Seed, www.developmentseed.org, Washington, DC

Contact Information

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