

Three Mile Island Alert Inc.'s Testimony  
Re: Federal Register Volume 80, Number 76  
(Tuesday, April 21, 2015) [Notices] [Pages 22231-22232]  
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NUCLEAR REGULATORY COMMISSION

June 4, 2015

Bloomsburg, Pa.

4/21/2015  
80 FR 22231  
(8)

NUREG-2179, "Draft Environmental Impact Statement (EIS) for Combined Licenses for Bell Bend Nuclear Power Plant." The draft EIS will be available on Regulations.gov under Docket ID NRC-2008-0603.

[Docket No. 52-039; NRC-2008-0603]

Bell Bend Nuclear Power Plant

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## **Executive Summary:**

Pennsylvania Power Light (“PPL”) submitted the application on October 10, 2008, for the construction of a new reactor – the Bell Bend Nuclear Power Plant (“BBNPP”) – on a site adjacent to the Susquehanna nuclear power plant, which the company also owns and operates. The proposal calls for the use of a single U.S. Evolutionary Power Reactor (“EPR”) at the site. That design has not yet been approved by the Nuclear Regulatory Commission (“NRC”).

On September 17, 2012, the NRC staff informed PPL that they did not have sufficient information for the draft EIS sections regarding consumptive water use. On November 28, 2012, and February 19, 2014, the NRC staff issued requests for additional information (“RAI”) to PPL regarding consumptive water use and held an audit the week of March 17, 2014. After thorough review of PPL’s response to the RAIs and supplemental information provided during and following the audit, the NRC and United States Army Corps of Engineers (“USACE”) now agree that PPL has provided sufficient information to allow both agencies to proceed with the draft EIS.

The environmental review schedule has been principally impacted by technical challenges. There has not been a resolution to consumptive water use, surface water withdrawals or an approved plan for compensatory measures.

On April 24, the NRC and Army Corps, Baltimore District, issued the Draft Environmental Impact Statement ("DEIS.") The NRC staff's preliminary environmental recommendation is that a license for the new reactor could be issued. This recommendation is based on the application, including the environmental report submitted by the company; consultation with federal, state, tribal, and local agencies; the NRC review team's independent evaluations; the consideration of public comments; and the assessments summarized in the draft environmental report.

The NRC staff's preliminary environmental recommendation is that the license could be issued. The staff's conclusion is based on its review of information in the application submitted by PPL Bell Bend. The review took into account consultations with other federal agencies.

The NRC and USAEC's conclusions are cursory, fatally flawed and reek of regulatory negligence. There is no approved reactor design. There is no approved consumptive water use permit. There is no money.

TMI-Alert will request a formal audit by the Government Accountability Office to determine if regulatory collusion and willful manipulation of data has taken place.

### **1) There is no approved reactor design.**

The French-owned AREVA nuclear corporation has requested that the US Nuclear Regulatory Commission suspend indefinitely its design certification review of the US Evolutionary Power Reactor on February 25, 2015. Several US nuclear utilities have submitted applications for combined construction and operation licensing to the federal agency.

Despite receiving roughly \$8 billion in federal loan guarantees from the US Department of Energy, Constellation bailed out of the financially dubious project in 2012 leaving EdF, France's state-run nuclear corporation as the sole entity in UniStar and in clear violation of the US Atomic Energy Act which prohibits foreign ownership, control and domination of US nuclear projects. Not one US utility stepped in to fill the vacant partnership with EdF. Instead, the NRC and US nuclear industry have gone into discussions to take a "fresh look" at the foreign ownership prohibition.

“UniStar, in the meantime has withdrawn its application to build the Nine Mile Point-3 EPR in upstate New York. Ameren has suspended its NRC application to build an EPR in Missouri. **PPL has likewise suspended its NRC application to build an EPR at Bell Bend, Pennsylvania.**”

“The AREVA announcement suspending the NRC design review process sows more doubt for French reactors in the US ever being constructed, given that a license cannot be issued without the agency approving design safety.” (Source: Areva requests NRC to suspend US EPR design certification review The French-owned AREVA nuclear, NIRS, March 7, 2015.)

## **2) There is no water.**

PPL has never completed the application for consumptive water use, surface water withdrawals or provided an approved plan for compensatory measures to the Susquehanna River Basin Commission (“SRBC”). PPL has submitted a *pro forma* sketch that lacks substance, technical specifications and is not remotely close to being in final format. In fact, during low flows, water would have to come from upstream. There is not enough water to accommodate another nuclear power plant.

Communities and ecosystems that depend on limited water resources are adversely affected by the SSES which draws 40 million of water a day and returns the back wash at elevated temperatures. As of May 26, 2015, the Department of Environmental Protection is maintaining a drought watch for 27 Pennsylvania counties — including Luzerne County. Yet PPL is exempted from water conservation efforts. Should nuclear power plants continue to be exempt from drought restrictions?

Consumptive water use, surface water withdrawals and an approved plan for compensatory measures have not been approved by the Susquehanna River Basin Commission.

## **3) There is no money.**

PPL wants to build a new nuclear reactor, but needs a federal subsidy of \$4.5 billion or 80% of the projected cost of the project. This “nuclear loan” is guaranteed by the U.S. Treasury (that is - taxpayers); and the real cost, based on overruns in Florida and Texas, is actually \$10 billion! Which begs the obvious question: Why aren’t the shareholders of one the “best managed” and “most profitable utilities” (*Forbes Magazine*, December, 2007) assuming the risk for a multibillion dollar slam dunk?

Please note that Georgia Power's Vogtle nuclear plant will likely be delayed even further — months beyond the three-year delay that project developers have already acknowledged. A report by staff and engineers to the Georgia Public Service Commission extended the deadline by two to three months to begin work on concrete walls and hoisting a section of the plant into place. Regulators estimate it will cost Georgia Power \$2 million each day that it runs behind on the project's schedule. The first new reactor at the facility was slated to begin operations in April 2016, with another to follow a year after. Now, it will likely be sometime in 2019 and 2020 when those units come online. (Source: Utility.Drive.com. May 15, 2015).

PPL's operating nuclear plants were projected to cost \$2.1 billion, but cost overruns resulted in a \$4.10 billion price tag for rate payers. Don't be fooled again by the same people who brought you electricity "too cheap to meter."

1) The NRC and the U.S. Army Corps of Engineers should compel PPL to address, factor and analyze water use and site-specific aquatic challenges identified in Arnie Gundersen's Expert Testimony.

2) The NRC and the U.S. Army Corps of Engineers should compel PPL to address, factor and analyze water use and site-specific aquatic challenges identified in TMI-Alert's testimony.

3) The NRC and the U.S. Army Corps of Engineers should delay issuing a final Environmental Impact Study until the Susquehanna Basin River Commission approves PPL's applications for consumptive use, mitigating measures and surface water withdrawals.

## **I. Introduction.**

I am Eric Epstein ("Epstein" or Mr. Epstein"), the Chairman of Three Mile Island Alert, Inc. ("TMIA"). I am offering comments and testimony in opposition to the above mentioned Draft Environmental Impact Statement (DEIS").

## **II. Affected Interests.**

Mr. Epstein has clearly defined interests at stake in the Application submitted by PPL Bell Bend, and actively pursued those interests at the Nuclear Regulatory Commission ("NRC") and the Susquehanna River Basin Commission ("SRBC"). TMI-Alert actively monitored the construction, licensing and operation of the Susquehanna Steam Electric ("SSES") Station since 1984.

TMI-Alert is a safe-energy organization based in Harrisburg, Pennsylvania and founded in 1977 with 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 has 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 is the Chairman of TMI-Alert. He 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 Unit-2 and the forced shutdown of Peach Bottom Units 2 & 3 in 1987. TMIA's membership living within 50 miles of the proposed Bell Bend Nuclear Generating Station ("BBNPP" or "Bell Bend") have immediate concerns relating to the plant's operation.

TMIA's membership have legitimate and historic concerns regarding radiological contamination resulting from radiological releases related to normal and abnormal operations that impact the value of its 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. After a 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. (See Epstein Protest, para. 10.) (1) Mr. Epstein's most recent advocacy on behalf of TMIA membership living within proximity of the Susquehanna Steam Electric Station ("SSES") was well established at the NRC between 2006-2009. (2)

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1 PA PUC Commission, Public Meeting held July 14, 2005, A-110550F0160 Joint Application of PECO Energy Company and Public Service Electric and Gas Company for Approval of the Merger of Public Service Enterprise Group Incorporated with and into Exelon Corporation.

2 Re: PPL Susquehanna LLC Application for Susquehanna Steam Electric Station's Renewed Operating Licenses NPF-14 and NPF-22 Docket Nos. 50-387 PLA-6110 and 50- 388.



TMLA's history and mission are germane and important to this proceeding. Many TMI-Alert members live are subject to radiological contamination, evacuation, loss of property, or other harms in the event of any mishap at the plant. *Id.* Members also use, recreate, fish and enjoy the segment of the Susquehanna River adjacent and below the the proposed site. (3)

### **III. Background**

PPL Bell Bend failed to factor, consider and address numerous water use and site-specific aquatic challenges to the Susquehanna River and its environs if this Application is approved. The Applicant did not adequately consider the additional impact another nuclear power plant will have on environment, habitat and ecosystem.

A sample of the magnitude of the amount of water used at nuclear power plants is readily evidenced at PPL's Susquehanna Steam Electric Station located on the Susquehanna River in Luzerne County. The plant draws 0.86 million gallons per day from the Susquehanna River. For each unit, 14.93 million gallons per day are lost as vapor out of the cooling tower stack while 11 million gallons per day are returned to the River as cooling tower basin blow down. On average, 29.86 million gallons per day are taken from the Susquehanna River and not returned. This data is public information, and can be easily referenced by reviewing PPL's Pennsylvania Environmental Permit Report.

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3 An organization has standing to sue on behalf of its members when a member would have standing to sue in his or her own right, the interests at issue are germane to the organization's purpose, and participation of the individual is not necessary to the claim or requested relief." *Hunt v. Washington State Apple Advertising Cornrn*, 432 U.S. 333, 343 (1977).

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. (4)

Recent and consistent droughts in Pennsylvania (2002) as well as flooding (2006) have forced state and regulatory bodies to reexamine water as a commodity in the Commonwealth of Pennsylvania.

The SRBC Drought Management Information Sheet 5, droughts and low-water flow demonstrates that regular that droughts occur in the region. occurred quite recently, with droughts occurring every decade except the 1970s.

Mr. Gundersen sated, "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."

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4 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.

“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 1991, 1995, 1997, 1998, 1999, 2000, 2002 and 2006.” (5)

In addition, a number of infestations, specifically Asiatic clams and Zebra mussels, have required power plants to prepare plans to defeat these aquatic invasions.

The Applicant did not address water quality, water use, aquatic communities, groundwater use, entrainment and impingement, and impact microbiologic organisms throughout the license application, but offered only cursory and superficial data, and failed to address numerous issues that could adversely impact the area surrounding the the proposed plant.

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5 Gundersen, p. 16.

Nuclear power plants require large amounts of water for cooling purposes. PPL's Susquehanna Electric Steam Station power plant already removes large amounts water from the Susquehanna River. Animals and people who depend on these aquatic resources will also be affected Refer to Charts A-1 and A-2). PPL's Application will further place pressure on limited water resources. Freshwater withdrawals by Americans increased by 8% from 1995-2000, and Americans per capita water withdrawal is three times above the international average. (6)

Millions of fish (game and consumable), fish eggs, shellfish and other organisms are sucked out of the Susquehanna River and killed by nuclear power plants annually. Now large water consumers, including PPL, are compelled to invetorize mortality rates and identify species of aquatic life affected by water intakes. 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. (7) But any time you have a man-induced impact on top of what nature is doing, you're affecting the ecosystem, Young said.

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6 "U.S. National Report on Population and the Environment" (2006) published by the Center for Environment and Population, a nonprofit corporation based in Connecticut.

7 Ad Crable, *Intelligencer Journal*, January 15, 2005.

PPL Bell Bend has not disclosed or quantified the how many fish (game and consumable), fish eggs, shellfish will be killed annually if this Application is approved. Is the Corps in possession of this data? Has it been made available to the public for review? Has the Corps established “acceptable levels” of fish kills? If so, where can that data be found? What impact will the Application have on shad ladders? What impact will this Application have on sport and commercial fishing?

On July 9, 2004, the Environmental Protection Agency (EPA) issued the Final Phase II rule implementing Section 316 (b) of the Clean Water Act: The first national standards for reducing fish kills at existing plants. “The rule established requirements for reducing adverse environmental impacts from the entrainment and impingement of aquatic organisms living near power plants.”

What will the Corp’s compliance reporting requirements be in regard to onsite 316 (a) and 316 (b) monitoring? Where will the results be published? Has the Corps and EPA executed a MOU? What will the Corps compliance reporting requirements be in regard to off site tritium monitoring? Where will the results be published?

It is not uncommon for the plants to discharge chlorinated water (necessary to minimize bacterial contamination of turbines) or Clamtrol (chemical agent used to defeat Asiatic clam infestation) directly into the River. Will the water be treated with chemicals? How does PPL plan to defeat Asiatic clam and/or Zebra mussel infestations? (8)

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8 In February 1986, one celled organisms believed to be fungus, bacteria and algae like creatures were discovered at Three Mile Island. These creatures obscured the view of the reactor core and impeded the defueling of the damaged reactor.

DEP confirmed that zebra mussel adults and juveniles have been found in Goodyear Lake, the first major impoundment on the Susquehanna River's main stem below Canadarago Lake in New York. Zebra mussels are an invasive species posing a serious ecological and economic threat to the water resources and water users downstream in the river and Chesapeake Bay...In 2002, the first report of zebra mussel populations in the Chesapeake Bay Watershed were reported from Eaton Reservoir in the headwaters of the Chenango River, a major tributary to the Susquehanna River in New York. A short time later, zebra mussels also were found in Canadarago Lake, a lake further east in the Susquehanna main stem headwaters. Now, through DEP's Zebra Mussel Monitoring Network, reports were received that both zebra mussel adults and juveniles, called veligers, have made their way down to the Susquehanna main stem, (Pa DEP, Update, July 16, 2004.)

How does PPL plan to defeat Asiatic clam and/or Zebra mussel infestations?

Nuclear plants use millions of gallons daily for coolant and to perform normal industrial applications. There are five nuclear generation units on the Susquehanna River. 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 a River in a day. Bell Bend will increase the pressure on the River's resources.

In its application to the 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.

“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.”

“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.”

“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.”

“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.”

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.”

“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.” (9)

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9 Gundersen, p. 4.

How will the Corps account for the loss of water? How will the Corps track the chemicals dispersion and maintain a “chain of custody?” How often will the Corps test for differential water temperatures?

“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.”

“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.” (10)

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**Note: Bold face type added.**

10 Gundersen, p. 10



“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 blow down water will be approximately 20 degrees hotter than the river water to which it is being returned.”

“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.”

“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.” (11)

Water quality, fish kills, thermal inversion and effluent discharges, need to be included and factored into the Bell Bend Application.

Water shortages on the Lower Susquehanna reached critical levels in the summer of 2002. During the 2002 drought, the SSES was exempted from water conservation efforts. For the month of August 2002, 66 of 67 Pennsylvania counties had below normal precipitation levels. (12)

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**Note: Bold face type added.**

11 Gundersen, p. 10

12 Pennsylvania Department of Environmental Protection, *Drought Report and Drought Conditions Summary*, August-September, 2002).

The U.S. Geological Survey stated that "...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."

Gundersen observed, "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." (13)

What actions will Bell Bend take to curb water use during periods of conservation and/or drought?

#### **IV. Gundersen Testimony Relating to Impact K, M and O.**

Enclosed please find the Testimony and Vitae of Arnold Gundersen.

Mr. Gundersen's Testimony speaks to the negative impacts embedded in the current DEIS as outlined in Re: PPL Bend Nuclear Power Plant's Application Number NAB 20008-01401-P13 (Bell Bend Nuclear Power Plant) Before the U.S. Army Corps of Engineers

- \* Impact K (See Discussion on pp. 3, 4 & 15).
- \* Impact M (See Discussion on pp. 10, 15 & 22).
- \* Impact O (See Discussion on pp. 10, 15 & 22).

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13 Gundersen, p.16

## **V. On Site Alternatives**

“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.

“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.” (14)

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14 Gundersen, pp. 18 & 22.

## **VI. Compensatory Measures and Alternatives Fall Under the Purview of the SRBC.**

It is clear black letter law that issues relating to "Compensatory Measures" in the PPL's Application fall Under the unambiguous purview of the SRBC.

"18 CFR § 803.42 H) Other alternatives. (2) Alternatives to compensation may be appropriate such as discontinuance of that part of the project's operation that consumes water, imposition of conservation measures, utilization of an alternative source that is unaffected by the compensation requirement, or a monetary payment to the commission in an amount to be determined by the commission from time- to-time.

In Fact the SRBC explicitly told the NRC and USACE of Engineers during the Scoping Process that PPL would need approval for water withdrawal, consumptive use and mitigating strategies"

Water Withdrawal. In accordance with the standard contained in SRBC regulations, the surface water withdrawal and the groundwater withdrawal may not cause significant adverse impacts to the water resources of the basin. In its evaluation, SRBC staff may consider effects on stream flows and other users; water quality degradation that may be injurious to any existing or potential water use; effects on fish, wildlife, or other living resources or their habitat; and effects on low flows of perennial or intermittent streams. SRBC staff also considers the reasonable foreseeable water needs of a project. SRBC staff evaluates each proposed withdrawal to determine the need for a protective passby flow condition, which restricts the ability to take water during low flow conditions. SRBC staff undertakes that evaluation using criteria that are applicable to all surface water and groundwater withdrawals influencing surface water. This protocol,

adopted in 2003, enables SRBC to evaluate the impact of the withdrawal and involves looking both upstream and downstream to assess cumulative impact, taking into account all other withdrawals and discharges and their impacts on the resource, particularly during low flow periods...Because a passby flow is the "trigger" for projects to cease their withdrawal during low flows, upstream storage is typically necessary for projects pursuing non-interruptible withdrawals to allow continued operations during all flow conditions. Should SRBC determine that the requested surface water withdrawal cannot be approved without a passby condition, PPL would need to provide for water storage upstream of BBNPP to assure that all sections of the Susquehanna River are protected during periods of low flow." (0004-3 [Richenderfer, James])

"Consumptive Water Use. Consumptive use is defined by SRBC as the loss of water withdrawn from the basin through a process by which the water is not returned to the waters of the basin undiminished in quantity including, but not limited to, evaporation, transpiration by vegetation, incorporation in products during their manufacture, injection into a subsurface formation, and diversion out of basin. In accordance with SRBC regulations, PPL must propose (and the SRBC commissioners must approve) mitigation for its requested consumptive water use of 28 mgd. SRBC staff finds appropriate mitigation for consumptive use by a new facility of this magnitude and at this location must be in the form of compensatory water or discontinuance of use during designated low flow periods rather than payment of the mitigation fee.

PPL is proposing an innovative approach of pooling its various water storage "assets" to meet its consumptive use mitigation requirements at several existing projects within the basin and at the proposed BBNPP facility. This approach was presented to the commissioners in the form of a general concept and not a specific plan on June 23, 2011. PPL refers to the plan as the Stored Asset Plan (SAP). PPL has not made a formal submission to the SRBC of the SAP; however, applications for several assets within the SAP have been submitted for review. The U.S. Nuclear Regulatory Commission (NRC) and

other appropriate agencies will be on the distribution list for relevant correspondence pertaining to the SAP. Some of the details required in the plan include a list of specific water supply assets located upstream of BBNPP that are being considered as part of the SAP proposal, including the proposed amount of mitigation and Page 10 of 38 expected licensing/permitting or contractual actions for each asset. In addition to sources of storage being identified, all necessary agreements among the different entities, both within the PPL corporate structure and any other project sponsors or owners of assets, must be resolved prior to approval of an asset into the SAP. As a separate action from the BBNPP applications, SRBC staff will make a recommendation to the commissioners regarding acceptance, modification, or rejection of the consumptive use mitigation plan. (0004-1 [Richenderfer, James]) (15)

The SRBC has suspended review of PPL's applications.

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15 Tomeka L. Terry, Project Manager/RA/ Environmental Projects Branch Division of New Reactor Licensing Office of New Reactors  
SUBJECT : SCOPING SUMMARY REPORT RELATED TO THE ENVIRONMENTAL SCOPING PROCESS FOR THE BELL BEND NUCLEAR POWER PLANT COMBINED LICENSE APPLICATION, April 21, 2014, pp. 10-11

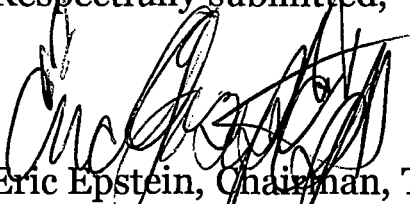
## **VII. Remedies:**

1) The NRC and the U.S. Army Corps of Engineers should compel PPL to address, factor and analyze water use and site-specific aquatic challenges identified in Arnie Gundersen's Expert Testimony.

2) The NRC and the U.S. Army Corps of Engineers should compel PPL to address, factor and analyze water use and site-specific aquatic challenges identified in TMI-Alert's testimony.

3) The NRC and the U.S. Army Corps of Engineers should delay issuing a final Environmental Impact Study until the Susquehanna Basin River Commission approves PPL's applications for consumptive use, mitigating measures and surface water withdrawals.

Respectfully submitted,



Eric Epstein, Chairman, TMI-Alert  
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Harrisburg, PA 17112  
(717)-635-8615  
lechambon@comcast.net

## **Enclosures:**

- **Expert Testimony of Arnie Gundersen**
- **Testimony of TMI-Alert.**

# EXHIBIT A



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)<sup>1</sup>, 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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<sup>1</sup> **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.”<sup>2</sup>

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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<sup>2</sup> 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*<sup>3</sup> 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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<sup>3</sup> **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/physci/physical/jones/student/olc/student\\_glossary.mhtml](http://www.mhhe.com/physci/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 algacides 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).”<sup>4</sup>

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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<sup>4</sup> 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<sup>5</sup>, 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.<sup>6</sup>

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

<sup>6</sup> *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 in 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*<sup>7</sup>. 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

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<sup>7</sup> <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.

Arnold Gundersen 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 Fairma Cole, 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 prudence 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, 1<sup>st</sup> 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](http://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](http://www.developmentseed.org), Washington, DC

**Contact Information**

Address: 376 Appletree Point Road, Burlington, VT 05408

E-Mail: [arnie@fairewinds.com](mailto:arnie@fairewinds.com)

Telephones: Office: (802) 865-9955 Cell: (802) 238-4452 Fax: (802) 304-1051

*End*

# EXHIBIT B

Before the U.S. Nuclear Regulatory Commission  
Three Mile Island Alert Inc.'s Comments  
Re: PPL Bend LLC; Bell Bend Nuclear Power Plant  
Combined License Application;  
Notice of Intent to Conduct A Supplemental Scoping  
Process on the Revised Site Layout  
(Docket ID NRC-2008-0603)

July 16, 2012,

Cindy Bladey, Chief Rules, Announcements and Directives Branch (RADB)  
U.S. Nuclear Regulatory Commission  
Office of Administration  
Mail Stop TWB-05-BO1M,  
Washington, D.C. 20555-0001

**I. Introduction.**

I am Eric Epstein ("Epstein" or Mr. Epstein"), the Chairman of Three Mile Island Alert, Inc. ("TMIA" or "TMI-Alert").

In that capacity, I am offering comments and testimony relating to PPL Bend Nuclear Power Plant's ("Bell Bend") Combined License Application; Notice of Intent to Conduct A Supplemental Scoping Process on the Revised Site Layout requested by the U.S. Nuclear Regulatory Commission (Docket ID NRC-2008-0603) .

Similarly, I am providing additional comments regrinding PPL Bend Nuclear Power Plant's Application Number NAB 20008-01401-P13 before the U.S. Army Corps of Engineers

## **II. Affected Interests.**

Mr. Epstein has clearly defined interests at stake in the Application submitted by PPL Bell Bend ("PPL" or "the Applicant") , and actively pursued those interests at the Nuclear Regulatory Commission ("NRC") and the Susquehanna River Basin Commission ("SRBC"). TMI-Alert actively monitored the construction, licensing and operation of the Susquehanna Steam Electric ("SSES") Station since 1984.

TMI-Alert is a safe-energy organization based in Harrisburg, Pennsylvania and founded in 1977 with 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 has 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 is the Chairman of TMI-Alert. He 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 Unit-2 and the forced shutdown of Peach Bottom Units 2 & 3 in 1987. TMIA's membership living with 50 miles of the the proposed Bell Bend Nuclear Generating Station ("BBNPP" or "Bell Bend") have immediate concerns relating to the plant's operation.

TMIA's membership have legitimate and historic concerns regarding radiological contamination resulting from radiological releases related to normal and abnormal operations that impact the value of its 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. (See Epstein Protest, para. 10." (1)

Mr. Epstein's most recent advocacy on behalf of TMIA membership living within proximity of the Susquehanna Steam Electric Station ("SSES") was well established at the NRC between 2006-2009. (2) The nature of his own property and business interests, and his responsibility to his membership are undisputed. Epstein has Standing on behalf of Three Mile Island Alert, Inc. Three Mile Island Alert ("TMIA") Inc. TMIA has numerous members that reside in the Susquehanna Steam Electric Station's proximity and throughout the Susquehanna River Valley. These members have concrete and particularized interests that will be directly affected by this proceeding.

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1 PA PUC Commission, Public Meeting held July 14, 2005, A-110550Fo160 Joint Application of PECO Energy Company and Public Service Electric and Gas Company for Approval of the Merger of Public Service Enterprise Group Incorporated with and into Exelon Corporation.

2 Re: PPL Susquehanna LLC Application for Susquehanna Steam Electric Station's Renewed Operating Licenses NPF-14 and NPF-22 Docket Nos. 50-387 PLA-6110 and 50- 388.

Moreover, the Pennsylvania Constitution is clear in Article I, Natural Resources and the Public Estate Section 27.

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.

TMIA's history and mission are germane and important to this proceeding. Many TMI-Alert members live are subject to radiological contamination, evacuation, loss of property, or other harms in the event of any mishap at the plant. *Id.* Members also use, recreate, fish and enjoy the segment of the Susquehanna River adjacent and below the the proposed site. (3)

As demonstrated by the above discussion and attached supporting materials, many of the members represented by Three Mile Island Alert would have standing in their own right. The issues in relicensing are germane to TMIA's stated mission. And, the individual participation of the members is not necessary to the claims or requested relief.

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3 An organization has standing to sue on behalf of its members when a member would have standing to sue in his or her own right, the interests at issue are germane to the organization's purpose, and participation of the individual is not necessary to the claim or requested relief." *Hunt v. Washington State Apple Advertising Cornrn*, 432 U.S. 333, 343 (1977).

### **III. Discussion**

PPL Bell Bend (“BNPP” or “Bell Bend”) has repeatedly ignored or failed to factor, consider and address numerous water use and site-specific aquatic challenges to the Susquehanna River and its environs if this Application is approved.

The Applicant did not adequately consider the additional and aggregate impact another nuclear power plant will have on environment, habitat and ecosystem.

The magnitude of the amount of water used at nuclear power plants is readily evidenced at PPL’s Susquehanna Steam Electric Station located on the Susquehanna River in Luzerne County. (4) The plant draws 0.86 million gallons per day from the Susquehanna River. For each unit, 14.93 million gallons per day are lost as vapor out of the cooling tower stack while 11 million gallons per day are returned to the River as cooling tower basin blow down. On average, 29.86 million gallons per day are taken from the Susquehanna River and not returned. This data is public information, and can be easily referenced by reviewing PPL’s Pennsylvania Environmental Permit Report.

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.

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4 The Susquehanna Electric steam Station Unit 1 was placed on the Degraded Cornerstone Matrix by the Nuclear Regulatory Commission in 2011 and this lowest ranked nuclear unit in Region I. Please refer to Enclosure 1 for a complete description of PPL’s declining performance.



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. (5)

Recent and consistent droughts in Pennsylvania (2002) as well as flooding (2006) have forced state and regulatory bodies to reexamine water as a commodity in the Commonwealth of Pennsylvania.

The SRBC Drought Management Information Sheet 5, droughts and low-water flow demonstrates that regular that droughts occur in the region. occurred quite recently, with droughts occurring every decade except the 1970s.

Mr. Gundersen sated, "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."

"Like floods, the magnitude of drought events can be categorized based on historical frequency, i.e., 5-year droughts, 10-year droughts, 50-yea droughts, etc. (The higher numbers indicate more severe, and less frequent, droughts.) Droughts can affect the entire basin or cause localized water shortages."

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5 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.

Please refer to Enclosure 2 for the Expert Witness Report of Arnold Gundersen.

“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 1991, 1995, 1997, 1998, 1999, 2000, 2002 and 2006.” (6)

In addition, a number of infestations, specifically Asiatic clams and Zebra mussels, have required power plants to prepare plans to defeat these aquatic invasions.

The Applicant did not address water quality, water use, aquatic communities, groundwater use, entrainment and impingement, and impact microbiologic organisms throughout the license application, but offered only cursory and superficial data, and failed to address numerous issues that could adversely impact the area surrounding the the proposed plant.

Nuclear power plants require large amounts of water for cooling purposes. PPL’s Susquehanna Electric Steam Station power plant already removes large amounts water from the Susquehanna River. Animals and people who depend on these aquatic resources will also be affected Refer to Charts A-1 and A-2). PPL’s Application will further place pressure on limited water resources. Freshwater withdrawals by Americans increased by 8% from 1995-2000, and Americans per capita water withdrawal is three times above the international average. (7)

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6 Gundersen, p. 16.

7 “U.S. National Report on Population and the Environment” (2006) published by the Center for Environment and Population, a nonprofit corporation based in Connecticut.

“Millions of fish (game and consumable), fish eggs, shellfish and other organisms are sucked out of the Susquehanna River and killed by nuclear power plants annually. Now large water consumers, including PPL, are compelled to inventory mortality rates and identify species of aquatic life affected by water intakes. 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. (8) “But any time you have a man-induced impact on top of what nature is doing, you're affecting the ecosystem,” Young said.

PPL Bell Bend has not disclosed or quantified the how many fish (game and consumable), fish eggs, shellfish will be killed annually if this Application is approved. Is the Corps in possession of this data? Has it been made available to the public for review? Has the Corps established “acceptable levels” of fish kills? If so, where can that data be found? What impact will the Application have on shad ladders? What impact will this Application have on sport and commercial fishing?

On July 9, 2004, the Environmental Protection Agency (EPA) issued the Final Phase II rule implementing Section 316 (b) of the Clean Water Act: The first national standards for reducing fish kills at existing plants. “The rule established requirements for reducing adverse environmental impacts from the entrainment and impingement of aquatic organisms living near power plants.”

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8 Ad Crable, *Intelligencer Journal*, January 15, 2005.

What will the Corp's compliance reporting requirements be in regard to onsite 316 (a) and 316 (b) monitoring? Where will the results be published? Has the Corps and EPA executed a MOU? What will the Corps compliance reporting requirements be in regard to off site tritium monitoring? Where will the results be published?

It is not uncommon for the plants to discharge chlorinated water (necessary to minimize bacterial contamination of turbines) or Clamtrol (chemical agent used to defeat Asiatic clam infestation) directly into the River. Will the water be treated with chemicals? How does PPL plan to defeat Asiatic clam and/or Zebra mussel infestations? (9)

DEP confirmed that zebra mussel adults and juveniles have been found in Goodyear Lake, the first major impoundment on the Susquehanna River's main stem below Canadarago Lake in New York. Zebra mussels are an invasive species posing a serious ecological and economic threat to the water resources and water users downstream in the river and Chesapeake Bay...In 2002, the first report of zebra mussel populations in the Chesapeake Bay Watershed were reported from Eaton Reservoir in the headwaters of the Chenango River, a major tributary to the Susquehanna River in New York. A short time later, zebra mussels also were found in Canadarago Lake, a lake further east in the Susquehanna main stem headwaters. Now, through DEP's Zebra Mussel Monitoring Network, reports were received that both zebra mussel adults and juveniles, called veligers, have made their way down to the Susquehanna main stem, (DEP, Update, July 16, 2004.)

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9 In February 1986, one celled organisms believed to be fungus, bacteria and algae like creatures were discovered at Three Mile Island. These creatures obscured the view of the reactor core and impeded the defueling of the damaged reactor. 9

How does PPL plan to defeat Asiatic clam and/or Zebra mussel infestations?

Nuclear plants use millions of gallons daily for coolant and to perform normal industrial applications. There are five nuclear generation units on the Susquehanna River. 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 a River in a day. Bell Bend will increase the pressure on the River's resources.

In its application to the 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.

"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."

"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."

"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."

"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."

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.”

“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.” (10)

How will the Corps account for the loss of water? How will the Corps track the chemicals dispersion and maintain a “chain of custody?” How often will the Corps test for differential water temperatures?

“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.”

“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***.”

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10 Gundersen, p. 4.

### **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.” (11)

“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 blow down water will be approximately 20 degrees hotter than the river water to which it is being returned.”

“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.”

“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.” (12)

Water quality, fish kills, thermal inversion and effluent discharges, need to be included and factored into the Bell Bend Application.

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**Note: Bold face type added.**

11 Gundersen, p. 10, (36.1)

12 Gundersen, p. 10, (38)

Water shortages on the Lower Susquehanna reached critical levels in the summer of 2002. During the 2002 drought, the SSES was exempted from water conservation efforts. For the month of August 2002, 66 of 67 Pennsylvania counties had below normal precipitation levels. (13)

The U.S. Geological Survey stated that "...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."

Gundersen observed, "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." (14)

What actions will Bell Bend take to curb water use during periods of conservation and/or drought?

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13 Pennsylvania Department of Environmental Protection, *Drought Report and Drought Conditions Summary*, August-September, 2002).

14 Gundersen, p. 16.



**IV. Expert Testimony of Arnold D. Gundersen, MSNE,  
Regarding Consumptive Water Use of the Susquehanna River  
by the Proposed Bell Bend Nuclear Power Plant. (15)**

“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.”

“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.”

“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.” (16)

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15    Enclosure 2: Testimony and Vitae of Arnold Gundersen.

16    Gundersen, p. 22.

**V. Expert Testimony of Keith L. Harner, P.E., Regarding PPL's  
"Conceptual Proposal to Develop and Implement A Cooperative  
Storage Asset Pool for Consumptive Use Mitigation." (17)**

"The establishment of a cooperative and coordinated pooled asset program for consumptive use mitigation between stakeholders has the potential to offset negative impacts on the Susquehanna River system. However, the pooling proposal from PPL (which includes PPL and SRBC controlled facilities) does not meet or exceed existing regulations."

"A pooled asset plan should make it possible to utilize different mitigation sources to protect different sections of the river system, but the use of the Holtwood reservoir provides mitigation flow well below the consumptive uses of PPL. That release would only help the Conowingo Reservoir (Baltimore city) and the Chesapeake Bay."

"The lower Susquehanna River is one of the most vulnerable sections of the river during low flows. This proposal does not protect that section of the river. Even when all PPL's statements are assumed to be true (including that the 3<sup>rd</sup> party mitigation flows would be provided upstream of the proposed Bell Bend facility) there remains reduced flows in sections of the West Branch and lower Susquehanna River." (18)

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17     Enclosure 3: Testimony and Vitae of Keith L. Harner.

18     Harner, p. 12.

## **VI. On Site Alternatives**

"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.

"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." (19)

## **VII. Compensatory Measures and Alternatives Fall Under the Purview of the SRBC.**

It is clear black letter law that issues relating "Compensatory Measures" in the Present Application fall under the unambiguous purview of the SRBC.

18 CFR § 803.42 H) Other alternatives. (2) Alternatives to compensation may be appropriate such as discontinuance of that part of the project's operation that consumes water, imposition of conservation measures, utilization of an alternative source that is unaffected by the compensation requirement, or a monetary payment to the commission in an amount to be determined by the commission from time- to-time.

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19 Gundersen, pp. 18 & 22.

## **VIII. Remedies:**

1) The U.S. Army Corps of Engineers should convene public hearings pursuant to PPL Bend Nuclear Power Plant's ("Bell Bend") Application ("PPL" or "the Applicant") number NAB 20008-01401-P13 to the U.S. Army Corps of Engineers ("the Corps), Re: PPL Bend Nuclear Power Plant's Application Number NAB 20008-01401-P13.

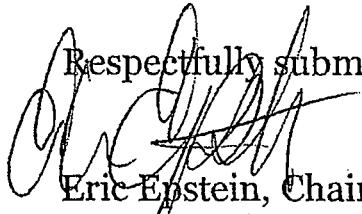
2) The U.S. Army Corps of Engineers should compel the Applicant to address, factor and analyze water use and site-specific aquatic challenges identified in TMI-Alert's comments.

3) It is clear black letter law that issues relating "Compensatory Measures" in this Scoping process fall under the unambiguous purview of the SRBC.

3) The US. Nuclear Regulatory Commission should compel the Applicant to address, factor and analyze water use and site-specific aquatic challenges identified in TMI-Alert's comments.

4) The US. Nuclear Regularity Commission should compel the Applicant to address, factor and analyze the issues raised by Arnold D. Gundersen in his Expert Testimony.

5) The US. Nuclear Regularity Commission should compel the Applicant to address, factor and analyze the issues raised by Keith L. Harner in his Technical Evaluation.

 Respectfully submitted,

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**Enclosures:**

- Tables A-1 & A-2
- Enclosure 1: Testimony of Arnold D. Gundersen
- Enclosure 2: Testimony Keith L. Harner

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# Table A-1, Table A-2, Table A-3 & Table A-4

“Nuclear Power and the Threat To Drinking Water”

Environment America Research & Policy Center

U.S. Public Interest Research Group

January, 2012

**Table A-1: Total Population Receiving Drinking Water from Intakes within 50 Miles of Each US Nuclear Plant**

Plant	State	Total Population Receiving Drinking Water from Intakes within 50 Miles of Plant
Browns Ferry	Alabama	619,428
Palo Verde	Arizona	124,500
Arkansas Nuclear	Arkansas	475,437
San Onofre	California	2,295,738
Diablo Canyon	California	66,450
Millstone	Connecticut	893,827
Saint Lucie	Florida	124,700
Vogtle	Georgia	398,523
Braidwood	Illinois	283,767
Dresden	Illinois	382,267
La Salle	Illinois	283,443
Quad Cities	Illinois	245,971
Clinton	Illinois	157,835
Duane Arnold	Iowa	84,403
Wolf Creek	Kansas	63,947
Waterford	Louisiana	1,449,287
River Bend	Louisiana	13,803
Pilgrim	Massachusetts	1,206,352
Fermi	Michigan	1,580,621
Palisades	Michigan	389,057
D.C. Cook	Michigan	254,584
Monticello	Minnesota	873,838
Prairie Island	Minnesota	478,021
Grand Gulf	Mississippi	9,116
Callaway	Missouri	31,346
Fort Calhoun	Nebraska	579,626
Cooper	Nebraska	3,490
Seabrook	New Hampshire	3,921,516
Salem	New Jersey	2,900,971
Hope Creek	New Jersey	2,900,971
Oyster Creek	New Jersey	1,076,424



Table A-1: Total Population Receiving Drinking Water from Intakes within 50 Miles of Each US Nuclear Plant (cont'd.)

Plant	State	Total Population Receiving Drinking Water from Intakes within 50 Miles of Plant
Ginna	New York	815,873
FitzPatrick	New York	548,848
Nine Mile Point	New York	548,848
Indian Point	New York	11,324,636
Shearon Harris	North Carolina	1,686,425
McGuire	North Carolina	1,646,516
Brunswick	North Carolina	215,985
Perry	Ohio	2,132,775
Davis-Besse	Ohio	1,550,459
Limerick	Pennsylvania	3,901,396
Beaver Valley	Pennsylvania	1,878,905
Three Mile Island	Pennsylvania	1,155,630
Peach Bottom	Pennsylvania	1,059,176
Susquehanna	Pennsylvania	848,626
Catawba	South Carolina	1,370,934
Oconee	South Carolina	799,932
Summer	South Carolina	487,462
Robinson	South Carolina	151,010
Sequoyah	Tennessee	659,341
Watts Bar	Tennessee	551,341
Comanche Peak	Texas	1,243,514
South Texas	Texas	2,751
Vermont Yankee	Vermont	3,114,882
North Anna	Virginia	1,138,798
Surry	Virginia	883,551
Columbia Generating Station	Washington	188,312
Kewaunee	Wisconsin	202,581
Point Beach	Wisconsin	202,581
(Note: Some plants do not appear in this list, since no surface water systems in the EPA's registry were within 50 miles of those plants. In some cases, groundwater-based drinking systems may be located near those plants; this report does not deal with those systems.)		

Table A-2: Total Population Receiving Drinking Water from Sources within 12.4 miles (20 km) of U.S. Nuclear Plants

Plant	State	Total Population Receiving Drinking Water from Intakes within 12.4 Miles of Plant
Browns Ferry	Alabama	26,130
Arkansas Nuclear	Arkansas	38,930
Diablo Canyon	California	1,200
Millstone	Connecticut	56,473
Braidwood	Illinois	5,604
Dresden	Illinois	5,604
Wolf Creek	Kansas	2,679
Waterford	Louisiana	103,818
Pilgrim	Massachusetts	37,316
D.C. Cook	Michigan	27,397
Palisades	Michigan	32,418
Fermi	Michigan	60,334
Grand Gulf	Mississippi	912
Fort Calhoun	Nebraska	7,512
Seabrook	New Hampshire	47,785
Salem	New Jersey	6,199
Hope Creek	New Jersey	6,199
Ginna	New York	17,062
FitzPatrick	New York	29,400
Nine Mile Point	New York	29,400
Indian Point	New York	8,359,730
Shearon Harris	North Carolina	206,414
McGuire	North Carolina	895,538
Davis-Besse	Ohio	16,885
Perry	Ohio	59,946
Susquehanna	Pennsylvania	40,620
Beaver Valley	Pennsylvania	80,626
Peach Bottom	Pennsylvania	243,368
Three Mile Island	Pennsylvania	262,149
Limerick	Pennsylvania	923,538
Summer	South Carolina	8,303
Oconee	South Carolina	378,899
Watts Bar	Tennessee	2,359
Sequoyah	Tennessee	56,145
Comanche Peak	Texas	11,750
Vermont Yankee	Vermont	31,543
Surry	Virginia	422,300
Columbia Generating Station	Washington	49,319
Point Beach	Wisconsin	13,354

**Table A-3: Total Population Receiving Drinking Water from Intakes within 50 Miles of Nuclear Plants by State**

State	Population Receiving Drinking Water From Intakes Within 50 Miles of Nuclear Plants
Alabama	586,253
Arkansas	475,437
Arizona	124,500
California	2,362,188
Connecticut	1,511,605
Florida	124,700
Georgia	577,361
Iowa	278,996
Illinois	652,804
Indiana	219,766
Kansas	63,947
Louisiana	1,471,531
Massachusetts	4,821,229
Maryland	208,442
Maine	94,948
Michigan	1,521,523
Minnesota	935,100
Missouri	31,346
North Carolina	3,753,495
Nebraska	518,302
New Hampshire	374,368
New Jersey	3,286,373
New York	9,974,602
Ohio	2,844,794
Oregon	15,410
Pennsylvania	6,651,752
Rhode Island	63,499
South Carolina	1,185,917
Tennessee	803,424
Texas	1,246,265
Virginia	2,022,349
Vermont	31,440
Washington	172,902
Wisconsin	202,581
West Virginia	65,426
<b>Total</b>	<b>49,274,575</b>

**Table A-4: Total Population Receiving Drinking Water from Intakes within 12.4 Miles (20 km) of Nuclear Plants by State**

State	Population Receiving Drinking Water From Intakes Within 12.4 Miles of Nuclear Plants
Alabama	26,130
Arkansas	38,930
California	1,200
Connecticut	56,473
Illinois	5,604
Kansas	2,679
Louisiana	104,730
Massachusetts	93,444
Maryland	117,719
Michigan	92,752
North Carolina	1,101,952
Nebraska	7,512
New Hampshire	11,000
New Jersey	6,199
New York	8,406,192
Ohio	92,031
Pennsylvania	1,414,196
South Carolina	456,966
Tennessee	58,504
Texas	11,750
Virginia	426,532
Vermont	12,200
Washington	49,319
Wisconsin	13,354
West Virginia	3,186
<b>Total</b>	<b>12,610,554</b>