DELAWARE RIVERKEEPER NETWORK

September 18, 2015

Pilar Patterson, Chief
Mail Code 401-02B
Division of Water Quality, Bureau of Surface Water Permitting
P.O. Box 420
Trenton, NJ 08625-0420

susan.rosenwinkel@dep.nj.gov

Re: Draft NJPDES #: NJ0005622
Issued for PSEG Nuclear LLC Salem Generating Station, Alloway Creek Neck Road, Lower Alloways Creek Twp, Salem County

Dear Ms. Patterson and Ms. Rosenwinkel,

The Delaware Riverkeeper Network submits this comment along with the attached expert reports, scientific and factual materials with regards to Draft NJPDES Permit NJ0005622 issued for PSEG's Salem Nuclear Generating Station (Salem) located in Lower Alloways Creek Twp, Salem County, NJ. We believe this draft permit fails to fulfill the requirements of the Clean Water Act and implementing regulations. We urge you with withdraw the draft permit, for the New Jersey Department of Environmental Protection (NJDEP) to undertake the limited additional analysis necessary and to issue a revised Draft NJPDES permit that honors the legal mandates and the spirit of the law, and one that provides the protections needed by the fish populations of the Delaware River and for the benefit of all those people who depend upon and appreciate having a healthy, diverse and sustainable aquatic community in our River.

Pursuant to section 316(b) of the Clean Water Act and implementing regulations, the NJ Department of Environmental Permit should issue a draft permit that mandates closed cycle cooling at Salem.

Section 316(b) of the Clean Water Act (CWA) requires facilities like the Salem Nuclear Generating Station (Salem) to use the best technology available (BTA) on the design, location, construction and capacity of their cooling water intake structures to minimize their adverse environmental impact. In 2014 the Environmental Protection Agency issued new regulations to guide implementation of § 316(b). According to the regulations, found at 40 C.F.R. 122.21(r) and 40 C.F.R. 125.90-98, each regulated facility subject to 316(b) must submit entrainment and impingement performance studies, select an impingement technology to be implemented, and provide a comprehensive technical feasibility and cost evaluation study of entrainment technologies with its National Pollutant Discharge

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Elimination System (NPDES) permit renewal application in order to inform that aspect of a final NPDES permit issued.[1] But, facilities with administratively extended permits, like Salem are not required to submit the studies required in 40 C.F.R. 122.21(r) as long as their permits are issued before July 14, 2018. 40 C.F.R. 125.98(g) allows NJDEP, in the case where permit proceedings began prior to October 14, 2014, as they have with Salem, to "proceed with a determination of BTA standards for impingement and mortality and entrainment without requiring the facility to submit the information required in 40 CFR 122.21(r)", when the Director determines the information already submitted by the facility is sufficient. Should the Director determine he has sufficient information, his BTA determination "may be based on *some or all of the factors* in paragraphs [40 CFR 125.98] (f)(2) and (3) of this section and the BTA standards for impingement mortality at § 125.95(c)."[2]

As explored in great detail below, NJDEP has sufficient information in the areas outlined in 40 C.F.R. 125.98 (f)(2) and (f)(3), including Salem's significant entrainment impacts on the Delaware River, to make a determination that closed cycle cooling is BTA for the facility but has failed to use its best professional judgment to do so. Nonetheless, assuming *arguendo* that NJDEP may appropriately move forward with an interim BTA assessment per 40 C.F.R. 125.98(b)(6)[3], NJDEP must establish interim BTA requirements in Salem's permit based on the agency's best professional judgment on a site-specific basis in accordance with §125.90(b)[4] and 40 C.F.R. 401.14[5]. NJDEP has failed to exercise its BPJ in its interim BTA assessment.

PSEG's permit for Salem expired in 2006; the current draft permit issued on June 30, 2015 was issued as the result of a legal challenge brought by the Delaware Riverkeeper Network, NJ Clean Water Action and NJ Sierra Club. PSE&G had submitted its 2006 permit renewal application in a timely fashion under the law and as a result it has been allowed to operate since 2006 with a Clean Water Act permit that was first issued in 2001 and expired in 2006. As long as the new permit for Salem is finalized by July 14, 2018, NJDEP can and should use its best professional judgment, and information already on the record, to establish BTA for Salem. Given the years of data and analysis on the record for Salem, and given the extreme level of fish mortality inflicted by Salem through impingement and entrainment, as well as thermal impacts, on a wide variety of Delaware River fish species it would be irresponsible for NJDEP to give PSE&G a pass for another 5 years by allowing it to continue monitoring its massive fish kills rather than use best technology available to minimize those kills at the very achievable 95% level.

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[1] 40 CFR 122.21(r) specifically requires facilities to submit: (2) Source water physical data; (3) Cooling water intake structure data; (4) Source water baseline biological characterization data; (5) Cooling water system data; (6) A chosen method to comply with the Impingement Mortality Standard and a performance study if certain impingement technology is chosen; (7) Entrainment performance studies; (8) Operational status of each unit that uses cooling water; and, if the facility withdraws more than 125 mgd, the facility must additionally submit: (9) Entrainment Characterization Study; (10) A comprehensive technical feasibility and cost evaluation study of entrainment technologies; (11) A benefits valuation study; (12) A non-water quality environmental and other impact study.

[2] 40 C.F.R. 125.98(g)

[3] *See* 40 CFR 125.98(b)(6) (In the case of any permit issued after October 14, 2014, and applied for before October 14, 2014 . . . The Director must establish interim BTA requirements in the permit on a site-specific basis based on the Director's best professional judgment in accordance with § 125.90(b) and 40 CFR 401.14).

[4] 40 C.F.R. 125.90(b) (Cooling water intake structures not subject to requirements under §§ 125.94 through 125.99 or subparts I or N of this part must meet requirements under section 316(b) of the CWA established by the Director on a case-by-case, best professional judgment (BPJ) basis).

[5] 40 CFR § 401.14 Cooling water intake structures. ("The location, design, construction and capacity of cooling water intake structures of any point source for which a standard is established pursuant to section 301 or 306 of the Act shall reflect the best technology available for minimizing adverse environmental impact, in accordance with the provisions of part 402 of this chapter.)

Among the factors presented in 40 CFR 125.98(f)(2) and (f)(3) that the Director can base a BTA determination on are: the number of organisms entrained, including endangered species; land availability as it relates to the feasibility of a particular entrainment technology; remaining plant life; quantified/qualitative social benefits and costs of available entrainment technologies when such information on both benefits and costs is of sufficient rigor to make a decision; thermal discharge impacts; and impacts on the reliability of energy delivery within the immediate area. When these factors are applied to Salem it becomes clear that BTA is closed cycle cooling and that there is ample evidence, data and information to support, and even dictate, that best professional judgment would mandate a requirement of closed cycle cooling at Salem.

- Given the well documented entrainment and impingement data on the record demonstrating Salem impinges and entrains over 14 billion fish, eggs and larva in a given year;
- Given the high level of age 1 equivalent fish that are lost from the Delaware River fish population as a result of impingement, entrainment and thermal impacts;,
- Given the endangered and threatened species impacted by Salem
- Considering the extended operational life given to Salem by the Nuclear Regulatory Commission;
- Given the facility's location in a sensitive and important estuary ecosystem;
- Given the cost analysis and technical analyses/comments included with this comment;
- Given the importance of commercial and recreational fishing to our region and the high level of takes by Salem of species targeted by commercial and recreational fishers; and
- Given the clear availability of closed cycle cooling at Salem both technologically and economically, so much so that NJDEP (based on its own hired experts) sought to require application of this technology at Salem 25 years ago;

Looking at all impingement and entrainment at Salem: 14.6 billion fish, eggs and larvae are killed a year in its once through cooling water intake structures.

(ECONorthwest analysis attached relying upon US EPA, 316(b) Case Studies, Part B: The Delaware Estuary.)

When just considering a limited set of species deemed Representative Import Species (RIS) by PSEG, data has shown the following levels of impingement and entrainment impacts:

Over 59 million Blueback Herring
Over 77 million Weakfish
Over 134 million Atlantic Croaker
Over 412 million White Perch
Over 448 million Striped Bass
Over 2 billion Bay Anchovy

(Figures provided are numbers of fish killed. Source: correspondence from US Fish & Wildlife Service to NJDEP, June 30, 2000 relying on PSE&G permit application data)

Best Professional Judgment and well-reasoned agency action would clearly dictate that NJDEP mandate the use of closed cycle cooling or its functional equivalent at Salem; to do otherwise would be arbitrary, capricious and an abuse of discretion and an absolute failure to, in good faith, exercise the agency's best professional judgment.

It is notable, that the US Fish & Wildlife Service made clear its position that the Best Technology Available is closed cycle cooling[6] thereby supporting the perspective that best professional judgment supports a closed cycle cooling mandate.

[6] USF&WS comment to NJDEP, Sept 17, 2015

The number of organisms impinged and entrained at Salem, including endangered species:
Every year, Salem kills an extreme number of fish, many of which are at depressed population levels within the Delaware River population/system, and some of which are endangered.

On average, every year, the Salem Nuclear Generating Station kills through entrainment 14.7 billion fish and impinges 6.6 million more at various life stages.

PSEG minimizes the perception of its impingement, entrainment and fish kill impacts by limiting its impingement and entrainment analyses to just a 10 or so species it has determined to be Representative Important Species (RIS) including: Alewife, American Shad, Atlantic Croaker, Bay Anchovy, Blueback Herring, Spot, Striped Bass Weakfish, White Perch, Blue Crab. But according to EPA's 316(b) Case Study, there are over 100 different kinds of fish vulnerable to impingement and entrainment by Salem and other CWIS' in the Delaware. [7]

According to a review by the US Fish and Wildlife Service of Salem's impingement and entrainment impacts on the 10 identified RIS species,[8] the Salem facility kills 5.5 million weakfish, striped bass, white perch, blueback herring, spot and other fish as the result of impingement.[9] An additional 3,327.9 million fish are lost due to entrainment.[10] This translates into over 3.3 billion killed due to impingement and entrainment a year at Salem when simply considering the 10 RIS species PSEG has identified.

Even PSE&G itself reports high kill levels – despite that previous reviews of PSE&G data by NJDEP hired consultants questioned and challenged the accuracy of their reported fish kills and figures, the level of fish mortality is so high that even PSE&G cannot mask the significance of its impingement and entrainment takes. For example, PSEG data shows annual impingement and entrainment takes of species as high as those noted on the table to the right …

Species	**Highest Take in a Single Year from 3 Year Time Frame Provided in NJDEP Fact Sheet**
Bay Anchovy	2,343,510,158
Atlantic Croaker	454,405,706
Striped Bass	403,748,868
Atlantic Menhaden	190,696,853
Weakfish	48,899,509
White Perch	26,592,221
Atlantic Silverside	44,922,417
Alewife	9,848,385
Blueback Herring	1,973,337
Spot	2,261,064

This table is based on the three years of data included in the NJDEP permit fact sheet years 2002, 2003, 2004.

PSEG uses averaging to try to reduce the perception of its annual impingement and entrainment levels, but when it comes to fish kills, including from a number of species that are already in decline or

[7] US EPA, 316(b) Case Studies, Part B: The Delaware Estuary, Table B3-1.
[8] US Fish & Wildlife Service to NJDEP, June 30, 2000 (relying on PSE&G permit application data)
[9] Impingement occurs when organisms are trapped against screening devices by the force of the water passing through the cooling water intake structure. Impingement can result in starvation and exhaustion, asphyxiation and descaling.
[10] Entrainment occurs when organisms are drawn through a cooling water intake structure into the facility's cooling system. Organisms that become entrained are generally relatively small forms of fish and shellfish species. As entrained organisms pass through a plant's cooling system they are subject to mechanical, thermal, and toxic stress. The mortality rate of entrained organisms is high.

only holding steady at significantly low levels, the annual take in a given year is significant and should not be masked by averaging.

According to the Versar report provided to NJDEP in 1989 "Entrainment of early life stages of fish, including recreationally and commercially important species was projected to result in high population losses…" at Salem.[11] "Entrainment, and to a lesser degree impingement, losses are projected to: 1) adversely affect important spawning and nursery functions, 2) result in adverse changes to the food web of the Delaware Estuary, and 3) adversely affect beneficial uses (i.e. fishing) of the receiving water body." [12] Versar determined Salem to be a threat to the protection and propagation of the balanced indigenous populations of fish inhabiting the Delaware Estuary unless significant reductions in impingement and entrainment were achieved.

Impingement and entrainment levels at Salem since Versar's analysis remain similarly extreme -- in fact Salem has the second largest CWIS take of fish in the nation as noted in our attached expert report from ECONorthwest – and while there has been some reduction in impingement impacts,[13] entrainment impacts remain historically high and according to Versar it is the entrainment impacts that have always been the biggest harm and threat inflicted by Salem (see quote above). As such Versar's findings regarding Salem's adverse impacts on the fisheries of the Delaware River are still valid and applicable.

Furthermore many of the fish species impacted by Salem are at declining or depressed levels and so experience magnified affects from Salem's takes. Additionally, Versar's assessment is repeated by a line of other expert reports and analyses in the years since it was completed for NJDEP (see below in comment for more discussion of other assessments and reports). According to Versar, it is essential that the entrainment impacts at Salem be reduced and that closed cycle cooling is the demonstrated technology that can accomplish the kinds of reductions necessary for a facility with the large intake flow volumes required by Salem.

In addition, more recently, the US Fish & Wildlife Service has expressed concerns about Salem entraining the larval form of horseshoe crabs, particularly with increasing sea level rise in the estuary.[14] While the horseshoe crabs are not currently listed as threatened or endangered, they are a primary food source for the Red Knot is currently listed as threatened and so entrainment of the larval form of horseshoe crabs may have an adverse impact on that threatened species.

The level of impingement and entrainment at Salem is extreme with additional species such as the horseshoe crab now coming into its range of impact, and therefore BPJ and well-reasoned agency action would mandate closed cycle cooling technology to minimize these adverse impacts on the Delaware River, Estuary and Bay. In addition, when you look at the high level of fish mortality and take inflicted by Salem as compared to the documented conditions of a number of those fish populations the actual significance of the impacts inflicted by Salem are magnified.

<u>Bay anchovy:</u>

[11] Versar Inc. ***Technical Review and Evaluation of Thermal Effects Studies and Cooling Water Intake Structure Demonstration of Impact for the Salem Nuclear Generation Station, Revised Final Report***, Prepared for NJDEP, 1989.
[12] Versar Inc. ***Technical Review and Evaluation of Thermal Effects Studies and Cooling Water Intake Structure Demonstration of Impact for the Salem Nuclear Generation Station, Revised Final Report***, Prepared for NJDEP, 1989.
[13] USF&WS comment to NJDEP, Sept 17, 2015
[14] USF&WS comment to NJDEP, Sept 17, 2015

Bay Anchovy are important forage fish for many species that are the target of commercial and recreational fisheries.

> "The bay anchovy is a species whose numbers have been decreasing at an alarming rate. These fish are usually one of the most abundant species in the Delaware estuary and are a primary food source for many fish inhabiting the river, including weakfish, bluefish and striped bass. The average number caught per seine haul … has been declining since 2000. Bay anchovy data correlates well with data from New Jersey Fish and Wildlife's Finfish Trawl Survey in Delaware Bay, which also indicates a bay anchovy decline since 1998."[15]

PSEG's data, as well as that of the US Fish and Wildlife Service, show bay anchovy takes in the range of 2 billion a year. This is a high level of take for a species that NJDEP itself describes as decreasing at an "alarming rate."

The Delaware City Refinery has a significantly lower impingement and entrainment take and kill rate as compared to Salem. One analysis found Bay Anchovy takes by the the Delaware City Refinery in 1998 to be in the 16 million to 17 million range. At this level it was "estimated that 19.0% of anchovy in the Delaware Bay and River stock were killed by the refinery in 1998." [16] According to this expert analysis: "The destruction of one-fifth of the anchovy stock in the Bay and River reduces the potential abundance and density of this important forage species to the point that attraction of desirable predators … to Delaware Bay and the production of younger predators targeted by the fisheries could be reduced to a significant degree. [17]

By comparison, Salem takes over 2 billion bay anchovy – well more than 100 times the level of take inflicted by the Delaware City Refinery.

Given that at a 19% take level of Bay Anchovy, the Refinery has been determined by experts to have the potential for "a noticeable impact on the total productivity of the Bay and River for the production of desirable predator species as well as reducing the attraction of adult predators" [18] it is most certain that Salem would be having these effects to a significantly higher degree given its massively higher impingement and entrainment takes and mortality levels for Bay Anchovy. In fact, Dr. Kahn has stated that "the combination of the refinery and the Salem Generating Station is certainly taking a significant part of the forage base of Delaware Bay." [19]

Clearly the continued use of once through cooling that will support Salem's continuing high level of Bay Anchovy impingement, entrainment and mortality is itself alarming and cannot be justified.

<u>Blueback herring and Alewife:</u>

[15] Bay Anchovy Fact Sheet, NJDEP, http://www.state.nj.us/dep/fgw/pdf/delriver/artdel_sp_bayanchovy.pdf
[16] D. Kahn, PhD., Impacts of Impingement and Entrainment Mortality by the Delaware City Refinery on Fish Stocks and Fisheries in the Delaware River and Bay, Delaware Division of Fish and Wildlife, Oct 9, 2008.
[17] D. Kahn, PhD., Impacts of Impingement and Entrainment Mortality by the Delaware City Refinery on Fish Stocks and Fisheries in the Delaware River and Bay, Delaware Division of Fish and Wildlife, Oct 9, 2008.
[18] D. Kahn, PhD., Impacts of Impingement and Entrainment Mortality by the Delaware City Refinery on Fish Stocks and Fisheries in the Delaware River and Bay, Delaware Division of Fish and Wildlife, Oct 9, 2008.
[19] D. Kahn, PhD., Impacts of Impingement and Entrainment Mortality by the Delaware City Refinery on Fish Stocks and Fisheries in the Delaware River and Bay, Delaware Division of Fish and Wildlife, Oct 9, 2008.

Blueback herring and Alewife have been identified by NOAA as a species of concern and one that has been experiencing declines throughout their range, including in the Delaware River.[20] Among the reasons for decline are fishing and increased predation—Salem, which takes over 7 million of these two fish combined a year, falls into both of these River Herring take categories (fishing and predation). The continued use of once through cooling that supports this continuing high level of take is unjustified given its impact on these species of concern.

American Shad:
The ASMFC has determined:

> " The American shad stock in the Delaware River is considered stable but at low levels compared to the historic population." [21]

As reported in the NJDEP fact sheet accompanying the Salem draft permit, Salem has killed as many as 72,486 American Shad in a single year. This is a significant figure for a stock that is considered significantly depressed from historic levels. The goal put forth by the ASMFC for Delaware River Shad is 750,000. Population estimates calculated for the years 2000 to 2006 provide an average population of only about 320,000 (less than half the target population) with the year 2006 estimate being in a mere 160,000 range. [22] Thus, the annual take of the shad population of the Delaware River by Salem is in the range of 23% to 45% of the entire population. (using the 2000 to 2006 average; and the 2006 estimate). Even if you use PSEG's 3 year average for their shad takes from 2002 to 2004 (also included in the NJDEP fact sheet) which is 29,837, you still have Salem impinging 9% to 19% of the Delaware River shad population a year.

Allowing these levels of take for a species determined to be at such low levels, and for a species that is of such recreational, cultural and historic importance to the Delaware River ecology, economies and communities is arbitrary, capricious and cannot be justified.

Because of concerns about American shad populations coast wide, and in the Delaware River, New Jersey has placed the following limitation on shad harvest:

> "Not more than 3 American shad in Del. Bay, River & tributaries."[23]

And so while commercial and recreational fishers have to limit their take of American Shad in an effort to preserve and restore the species and its populations Salem gets to take them indiscriminately, killing over 72,000 in a single year, without repercussion.

Weakfish:
Weakfish, while having a rich history for fishing, have suffered tremendous declines that has changed that picture, and they are now ill equipped as a population to sustain high level takes, particularly technologically avoidable ones, year after year. Weakfish are characterized as being among the dominant finfish collected from the Salem cooling water intake structures.

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[20] River Herring (Alewife & Blueback Herring), Species of Concern, NOAA National Marine Fisheries Service, 5/19/2009.
[21] Delaware River Sustainable Fishing Plan for American Shad, Prepared by the Delaware River Basin Fish & Wildlife Management Cooperative for The Atlantic States Marine Fisheries Commission Shad and River Herring Management Board, December 2011.
[22] 2007 Shad Stock Assessment Report Volume II ASMFC.
[23] http://www.state.nj.us/dep/fgw/pdf/2015/maregsum15.pdf

The Atlantic States Marine Fisheries Commission (ASMFC) has determined that weakfish populations in our region are in a "depleted state."[24]

For weakfish, Salem has "an estimated mortality rate of 17%"[25] -- that means Salem kills 1 out of every 6 weakfish in the Delaware River.

While in the past Weakfish were severely overfished, regulations and lack of population has significantly reduced their harvest by commercial or recreational fishers. The cut back on fishing, for a brief period, allowed the population to begin to rebound. But in recent years the natural mortality rate of Weakfish (deaths from natural causes such as being eaten and starvation) has been on the rise. Between 1982 and 1990 the biomass of Weakfish age 1+ declined from 113.1 million pounds to 17.6 million pounds. In 2008 the biomass of Weakfish age 1+ was only 10.8 million pounds.

As stated by the ASMFC:

> "Current removals, combined with high natural mortality rates, risk reducing the spawning stock to a level where poor year-classes become typical." [26]
>
> "The review panel agreed with the assessment's findings, concluding that the current level of fishery removals further exacerbates the decline in abundance (Sullivan et al. 2009). Consequently, the Management Board initiated the development of this addendum to consider options ranging from significantly reduced harvest to eliminating harvest (moratorium) in order to decrease fishing mortality. "[27]

Whether one characterizes Salem as a fishing take from the Weakfish population or not, it is adding to the pressure on an already depleted population size that needs reductions in takes all the way around in order to maximize its ability to rebound. Salem kills in the range of 50 to 80 million Weakfish a year. Thus Salem is contributing to the population declines being experienced by Weakfish of the Delaware River and is a contributing impediment to their ability to rebound. Salem's impact on the Weakfish population would be reduced through the implementation of closed cycle cooling. Allowing Salem to continue to take in the range of 50 to 80 million a year cannot be supported by sound policy or science.

<u>Striped Bass:</u>
Striped bass have been characterized as "the most valuable finfish produced in the Delaware River. They command a high price in commercial markets and are valued by recreational fishers…."[28]

By multiple accounts, including the NJDEP draft permit fact sheet, Salem can kill over 400 million striped bass a year.

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[24] Atlantic States Marine Fisheries Commission, ADDENDUM IV TO AMENDMENT 4 TO THE WEAKFISH FISHERY MANAGEMENT PLAN, Nov 2009.
[25] D. Kahn, PhD., Impacts of Impingement and Entrainment Mortality by the Delaware City Refinery on Fish Stocks and Fisheries in the Delaware River and Bay, Delaware Division of Fish and Wildlife, Oct 9, 2008.
[26] Atlantic States Marine Fisheries Commission, ADDENDUM IV TO AMENDMENT 4 TO THE WEAKFISH FISHERY MANAGEMENT PLAN, Nov 2009.
[27] Atlantic States Marine Fisheries Commission, ADDENDUM IV TO AMENDMENT 4 TO THE WEAKFISH FISHERY MANAGEMENT PLAN, Nov 2009.
[28] D. Kahn, PhD., ***Impacts of Impingement and Entrainment Mortality by the Delaware City Refinery on Fish Stocks and Fisheries in the Delaware River and Bay***, Delaware Division of Fish and Wildlife, Oct 9, 2008.

Looking at 1998 data, Dr. Kahn of DNREC determined that the number of Equivalent recruits at age 6 months from the Delaware City Refinery and Salem combined exceeded the number of striped bass survivors – in other words, they are killing more striped bass than are being left alive in the River!

> The estimated number of live 6-month old bass in 1998 was 1.274 million. "The number of Equivalent recruits at age 6 months from the [Delaware City] refinery kill was 0.471 million, and the number from Salem was 1.169 million. When the two estimates from the two plants are summed, the total is 1.640 million, which exceeds the number of survivors." [29]

As compared to Salem, the Delaware City Refinery is reported to take 8.5 to 16.5 million in a year – far less than Salem. According to Dr. Kahn, the "combined mortality rate [of the two plants] is larger than either individually." A greater focus on the cumulative impact of other facilities along with Salem for all impacted species, is clearly warranted and has not been provided.

This high level of take cannot be justified in light of the important recreational values of Striped Bass for our river and region.

Additionally, according to a year 2000 analysis conducted by Dr. Kahn of Salem's impact on Striped Bass populations of the River he determined that that the conditional mortality rate inflicted by Salem is "high enough to be of serious concern."[30]

More recently the state of Delaware evaluated the 2002 to 2004 data provided by PSEG in its permit application that is the basis of the NJDEP draft permit, and they determined that Salem "the mean annual adult equivalent biomass lost to the operation of [Salem] greatly exceeded Delaware's annual commercial striped bass quota"[31] (i.e. the biomass lost to Salem from 2002 to 2004 was 278,576 pounds per year while Delaware's annual commercial striped bass allowable quota is a mere 145,085 pounds per year). The estimate economic value of this loss to Salem was determined to be between $745,218 and $5,903,482. [32]

Salem is the largest industrial source of fish mortality on the Delaware River – there is no policy, legal or scientific justification to allow continued use of once through cooling and not to instead mandate closed cycle cooling or a comparable existing technology to reduce its fish mortality bootprint.

Impacts on threatened and endangered species is significant.

The outdated once through cooling system at Salem affects six aquatic species that are federally listed as endangered or threatened by the U.S. Fish & Wildlife Service: the Shortnose sturgeon; Atlantic sturgeon; Kemp's Ridley sea turtle; the Leatherback sea turtle; and the Green sea turtle are listed as "endangered," while the Loggerhead sea turtle is listed as "threatened."

[29] D. Kahn, PhD., ***Impacts of Impingement and Entrainment Mortality by the Delaware City Refinery on Fish Stocks and Fisheries in the Delaware River and Bay***, Delaware Division of Fish and Wildlife, Oct 9, 2008.
[30] D. Kahn, PhD., ***Mortality of Delaware River Striped Bass from Entrainment and Impingement by the Salem Nuclear Generating Station***, March 30, 2000.
[31] DNREC comment to NJDEP, Aug. 27, 2015.
[32] DNREC comment to NJDEP, Aug. 27, 2015.

In addition Salem discharges over 3 billion gallons of heated water per day into the Delaware Estuary. This unnaturally warm water harms the sensitive ecosystem of the Estuary and impacts these species and others is significant and concerning ways.

The Atlantic Sturgeon of the Delaware River are listed as endangered as part of the NY Bight DPS listed by the National Marine Fisheries Service. "In the NYB DPS, there are two known spawning populations – the Hudson and Delaware Rivers. While the Hudson is presumably the largest extant reproducing Atlantic sturgeon population, the Delaware is presumably very small and extremely vulnerable to any sources of anthropogenic mortality."[33] In addition the Delaware River population of the Delaware River has been identified as being genetically unique, with only 300 spawning adults left in this population,[34] and so even small takes can have significant population impacts.

The following takes of Atlantic Sturgeon at Salem have been documented for 2014 and 2015 through searches undertaken by the Delaware Riverkeeper Network. The identification of takes for 2015 is not presumed to be complete, these are the reports we were able to find through online searches and information requests:

Date: 3/25/15
Size: 812.8 mm length, 1.59 kg weight
Found in SGS Unit 1; CWI bay 12B
Found live. Released live.
Damage found at base of caudal fin and along the upper dorsal margin of the caudal fin.

Date: 12/22/14
Size: 701 mm total length; 1.3 kg weight
Found SGS Unit 1; CWI bay 12A
Deceased at time of retrieval by Salem Yard Crew. Cause of death unknown.

Date: 8/5/2014
Size: 76.0 cm length; 19.8 kg weight
Unit 1 CWI 11A
Missing head and tail.

Date: 4/18/2014
Size: 67.3 cm Length 1.20 kg Weight
Deceased presumed[35] Juvenile

[33] Final Rule, Threatened and Endangered Status for Distinct Population Segments of Atlantic, Sturgeon in the Northeast Region, Fed Reg Vol 77 No. 24, Feb. 6, 2012.
[34] NOAA Fisheries Service, Atlantic Sturgeon New York Bight Distinct Population Segment: Endangered, http://www.nmfs.noaa.gov/pr/pdfs/species/atlanticsturgeon_nybright_dps.pdf
[35] According to the Atlantic States Marine Fisheries Commission an Atlantic Sturgeon's life cycle can be determined by using the length-at-age table cited from asmfc.org below.

Life Interval	Age Range (years)	Fork Length (mm)	Total Length (mm)
Larvae	<0.08 < 30		
Juvenile	0.08-11	~20-1340	~30-1490
Non-spawning adults	> 12	> 1350	> 1500
Female spawners	> 15	> 1800	> 2000
Male spawners	12-20	> 1350-1900	> 1500-2100

Table 8-1. Age and size range of Atlantic sturgeon throughout their life cycle

Expert reviewer concluded cause of death unknown

Date: 4/9/2014
Size: 69.3 cm Length 1.30 kg Weight
Deceased presumed Juvenile
Expert reviewer concluded cause of death impingement

Date: 4/7/2014
Size: 70.2 cm Length, 1.48 kg Weight
Deceased presumed Juvenile
Expert reviewer concluded cause of death unknown

Date: 4/7/2014
Size: 70.2 cm 1.69 kg Weight
Alive presumed Juvenile

Date: 4/7/2014
Size: 67.6 cm Length 1.37 kg Weight
Alive presumed Juvenile

Date: 4/3/2014
Size: 63.0 cm Length 1.14 kg Weight
Alive presumed Juvenile (Damaged)

Date: 3/31/2014
Size: 77.0 cm Length
Alive presumed juvenile

Date: 3/27/2014
Size: 67.2 cm Length 1.35 kg Weight
Alive presumed Juvenile

Date: 2/20/2014
Size: 66.4 cm Length 1.31 kg Weight
Deceased presumed Juvenile
Expert reviewer concluded cause of death as impingement

Date: 2/19/2014
Size: 68.4 cm Length 1.37 kg Weight
Deceased presumed Juvenile
Expert reviewer concluded cause of death as impingement

Date: 2/12/2014
Size: 70.2 cm Length
Alive presumed Juvenile

Date: 1/27/2014
Size: 64.7 cm Length

Alive presumed Juvenile

Date: 1/27/2014
Size: 66.0 cm Length
Alive presumed Juvenile

Date: 1/8/2014
Size: 62.2 cm Length 1.2 kg Weight
Alive presumed Juvenile

Date: 1/6/2014
Size: 61.1 cm Length 0.927 kg Weight
Deceased presumed Juvenile
Expert review concluded cause of death by impingement

In addition to the 18 Atlantic Sturgeon found in the Salem intakes there were found at least 7 Shortnose sturgeon on: 3/13/14; 3/20/14; 4/15/14; 11/20/14; 11/21/14; and two on 12/10/14.

Furthermore we know there were at least 2 Kemp's Ridley Turtle takes reported on 7/9/14 and 9/3/14 – PSEG asserts the turtles had died prior to impingement at Salem (we have not been able to verify the accuracy of these assertions).

The NMFS Biological Opinion (BiOp) requires Salem to undertake certain Reasonable and Prudent Measures (RPMs) to minimize and monitor sturgeon takes. However, the BiOp does not take into account the cumulative impact of vessel strikes, a significant source of anthropogenic mortality. The BiOp only reports Brown and Murphy (2010) vessel strike mortality from 2005-2008 which doesn't even include all reports from that time period. Due to an increase in reporting enthusiasm adult Atlantic sturgeon vessel strike reports have increased from 17 in 2005-2008 to 43 from 2010-2013. When a reporting rate correction is applied to the 2010-2013 average, such as the James River 38% (Balazik et al 2012), estimated annual adult vessel strike mortality is 28.3. Considering cumulative effects, by combining the permitted lethal adult take of the Delaware population from all NMFS BiOp's, annual adult anthropogenic mortality is estimated to be 33.8. With a Delaware River adult population estimated to be <300 individuals the predicted mortality, F=0.11. This level of take mortality is greater than Boreman (1997) 50% of egg per recruit F of 0.05 that would be sufficient to rebuild the population. This analysis suggests that permitted lethal take of Delaware Atlantic sturgeon is currently not being managed for restoration and Salem is contributing significantly to Atlantic sturgeon mortality through impingement which is not considered in the NMFS BiOp.[36]

Salem is impacting threatened and endangered species in the estuary that have little capacity to absorb additional harms, particularly ones that are totally avoidable with a technology upgrade, as is the case at Salem with closed cycle cooling.

[36] See: Brown, J. J. and G. W. Murphy. (2010). Atlantic sturgeon Vessel-strike mortalities in the Delaware Estuary. *Fisheries*, vol 35(2), 73-83.; Balazik, M. T., Reine, K. J., Spells, A. J., Fredrickson, C. A., Fine, M. L., Garman, G. C., & McInninch, S. P. (2012). The potential for vessel interactions with adult Atlantic sturgeon in the James River, Virginia. *North American Journal of Fisheries Management*, *32*(6), 1062-1069.; Boreman, J. (1997). Sensitivity of North American sturgeons and paddlefish to fishing mortality. *Environmental Biology of Fishes*, *48*(1-4), 399-405.

It is also important to note that not only are there ecological benefits in avoiding the unnecessary adverse impacts to threatened and endangered species inflicted by Salem, but there are also economic benefits. Our federal government spends nearly $22 million a year to benefit and protect the endangered species of fish and turtle that Salem is legally allowed to kill every year. Installing closed cycle cooling to reduce impingement, entrainment and thermal impacts of Salem enhances the value of this economic investment and brings us closer to the day when it is no longer needed for these species. [37]

Remaining plant life: Salem has received a life extension that will extend its adverse environmental impacts for another 21 to 25 years, thus increasing the importance of minimizing its fish kills.

The Salem Nuclear Generating station, as the result of an extension of its operating license by the Nuclear Regulatory Commission will be operating for an additional 21 (Unit 1 license expires 2036) to 25 (Unit 2 license expires 2040) years. Given the length of time the facility has to still operate it is important that NJDEP ensure PSEG is taking all actions to avoid the adverse environmental impacts Salem inflicts on the Delaware Estuary, including the massive fish kills inflicted every day and every year by impingement and entrainment, as well as the harms inflicted by its heated water and pollution discharges.

The fact that the draft permit will allow Salem to continue its indiscriminate kills of over 14 billion Delaware River fish a year at multiple stages of life (thereby denying us the many benefits each life stage provides our estuary ecosystem) is itself a demonstration that the draft permit fails to meet NJDEP's obligation to use its best professional judgment to ensure "that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact" as mandated by section 316(b) of the Clean Water Act.

Quantified/Qualitative social benefits and costs of available entrainment technologies

The U.S. Fish & Wildlife Service reports that in 2006 fishing was the "favorite recreational activity in the United States" with 13% of the population 16 and older (29.9 million anglers) spending an average of 17 days fishing in that year alone.[38] As a result, in 2006, "anglers spent more than $40 billion on trips, equipment, licenses and other items to support their fishing activities." [39] Of this, 44% ($17.8 billion) was spent on items related to their trips, including food, lodging and transportation. [40]

The annual economic value of the Delaware River Basin is nearly $22 billion with 1.54 billion of that being ascribed to fish and wildlife activities.[41]

"Fishing, hunting, and bird watching/wildlife associated recreation employ 44,941 jobs with $1.5 billion in wages in the Delaware Basin including:

- Delaware (4,080 jobs earning $134 million in wages)

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[37] **ECONorthwest,** Economic Benefits of Installing a Closed-Cycle Cooling System at Salem Nuclear Generating Station, Final Report, **Sept, 2015.**

[38] US Fish and Wildlife Service. "*2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, National Overview."* (Preliminary Findings) May 2007. Pg. 5

[39] US Fish and Wildlife Service. "*2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, National Overview."* (Preliminary Findings) May 2007. Pg. 5

[40] US Fish and Wildlife Service. "*2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, National Overview."* (Preliminary Findings) May 2007. Pg. 5

[41] Gerald J. Kaufman, **Socioeconomic Value of the Delaware River Basin in Delaware, New Jersey, New York, and Pennsylvania,** *The Delaware River Basin, an economic engine for over 400 years,* Final Draft May 25, 2011.

- New Jersey (17,477 jobs earning $574 million in wages)
- New York (4,872 jobs earning $160 million in wages)
- Pennsylvania (18,512 jobs earning $608 million in wages)" [42]

"The annual value of fish landings [] in the tidal Delaware River and Bay is $25.4 million in $2000 or $34.1 million in $2010…"[43]

According to a 2007 report of the National Marine Fisheries Service discussed in the Gerald Kaufman economic valuation study of the Delaware River, [44] in a given year, and calculated using year 2000 dollars the following benefits were obtained from the Delaware River:

- ✓ 752,882 lbs of striped bass at a year 2000 economic value of $1,717,372 and a year 2010 economic value of $2,301,278
- ✓ 189,110 lbs of weakfish at a year 2000 economic value of $261,228 and a year 2010 economic value of $350,046
- ✓ 88,060 lbs of white perch at a year 2000 economic value of $84,500 and a year 2010 economic value of $113,230.

Healthy fish populations in our Delaware Estuary and River are incredibly important ecologically but also economically to our region. The takes by Salem significantly diminish these values to the region.

As with many species in the Delaware River, Shad fishing on the Delaware is important economically recreationally and culturally. The American Shad are celebrated in several cities throughout the watershed during their spring spawn including in Philadelphia and Easton, Pennsylvania and Lambertville, New Jersey. These festivals attract visitors from all over the region to learn about shad and the Delaware River, to enjoy festival offerings, and to spend money in the host cities, thereby providing another source of economic revenue dependent upon the species. The annual Shad fishing tournament held each year following the Easton Shadfest charges a $20 entry fee, and with over 1000 competitors in 2006, that tournament alone raised $20,000 in proceeds. Lambertville's Shadfest has been an annual part of the community for nearly 30 years, attracting 30,000 to 35,000 visitors during the two day event.

A recent analysis provided by the State of Delaware documented that the loss of striped bass due to Salem's takes can be as high as $5,903,482 a year,[45] that is just for one of the many species that Salem kills, and it is by no means the species with the highest level of take.

The reduced impingement and entrainment that would result from installation of closed cycle cooling at Salem would result in as much as $577 million in economic benefit considering just a 20 year time frame, [46] this is far greater than the deceptive and misleading figure of just $8 million put forth by PSEG.

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[42] Gerald J. Kaufman, **Socioeconomic Value of the Delaware River Basin in Delaware, New Jersey, New York, and Pennsylvania,** *The Delaware River Basin, an economic engine for over 400 years,* Final Draft May 25, 2011.
[43] Gerald J. Kaufman, **Socioeconomic Value of the Delaware River Basin in Delaware, New Jersey, New York, and Pennsylvania,** *The Delaware River Basin, an economic engine for over 400 years,* Final Draft May 25, 2011.
[44] Gerald J. Kaufman, **Socioeconomic Value of the Delaware River Basin in Delaware, New Jersey, New York, and Pennsylvania,** *The Delaware River Basin, an economic engine for over 400 years,* Final Draft May 25, 2011.
[45] DNREC comment to NJDEP, Aug. 27, 2015.
[46] **ECONorthwest,** Economic Benefits of Installing a Closed-Cycle Cooling System at Salem Nuclear Generating Station, Final Report, **Sept, 2015.**

Attached is a full analysis by ECONorthwest documenting the benefits of mandating closed cycle cooling at Salem – in terms of meeting the mandates of 316(b) and 316(a), in terms of the economic benefits that will be secured, the comparison of those benefits to the cost of installing closed cycle cooling, and clearly demonstrating PSEG's and Exelon's clear ability to pay.

PSEG's assertion that improving health in the Delaware Estuary and in finfish density demonstrates no adverse impacts from Salem is a flawed and false argument.

There have been significant water quality improvements in the Delaware Estuary since construction of Salem due to increased water quality regulations and technological advancements in discharging industries. Among the improvements have been dissolved oxygen levels. Improvements are such that fish propagation and other population benefits have been documented and the DRBC is studying the need for upgrading the Estuary's designated uses in order to comply with anti-degradation requirements of the Clean Water Act. That these and other improvements in Delaware Estuary conditions has provided benefits to the fish populations of the Delaware Estuary, Bay and River do not translate into an argument that Salem's destruction of over 14 billion fish a year at various life stages has not depressed fish populations and prevented even further enhancements and benefits to the Delaware Estuary's fish populations and the biological, recreational, commercial, economic, cultural and aesthetic values they provide.

In addition to the discussions provided above about specific species we offer the following expert opinions and discussion.

The US Fish and Wildlife Service has disagreed with PSE&G's assertions about having no adverse impact and characterizes the loss of aquatic organisms at Salem as "ecologically significant. In addition, conditional mortality rates for some Representative Important Species (RIS) are high enough to be of serious concern." [47]

According to an expert hired by the State of Delaware "Salem has, and will continue to have, important deleterious impacts on the fishery resources of Delaware Bay and adjacent coastal waters."[48]

In its most recent comments about Salem's operations and the NJDEP draft permit, DNREC stated that it "has found in both its previous and current analyses that the aquatic organism losses associated with the cooling water intake are substantial."[49] According to Delaware's most recent analysis, "The abundance of ecologically and economically important species such as alewife, American shad, Atlantic croaker, Atlantic menhaden, Atlantic silversides, bay anchovy, blue crab, blueback herring, spot, weakfish and white perch have all been reduced by the continued operation of the [Salem] cooling system." [50] And the State of Delaware goes on and "asserts that [Salem] will continue to have a substantial negative impact on multiple fisheries within the Delaware River Estuary, and that correlated cumulative primary and secondary losses will continue to impact the commercial and recreation fishing industries. "[51]

[47] US Fish & Wildlife Service to NJDEP, June 30, 2000 (relying on PSE&G permit application data)
[48] C. Philip Goodyear, Comments on Appendix F of the PSE&G Permit Application for Salem 4 March 1999, 12/13/99.
[49] DNREC Comment to NJDEP, Aug 27, 2015.
[50] DNREC Comment to NJDEP, Aug 27, 2015.
[51] DNREC Comment to NJDEP, Aug 27, 2015.

In the past, expert reviews commissioned by NJDEP have determined that PSEG has greatly underestimated its impacts on Delaware River fish and still, even with this undercounting of impacts, there have been significant concerns expressed regarding the impact of Salem on fish populations in the Estuary. According to ESSA Technologies Ltd, PSE&G "underestimates biomass lost from the ecosystem by perhaps greater than 2-fold." "… the actual total biomass of fish lost to the ecosystem … is at least 2.2 times greater than that listed" by PSE&G.[52]

Throughout the analysis provided by ESSA technologies to NJDEP in 2000, they found PSE&G analyses to include a variety of data gaps; biases; failure to substantiate analyses and/or findings; problems with sampling and PSE&G research; misrepresentations and/or unsubstantiated assertions by PSE&G; concerns about PSE&G analyses, assertions and/or findings.

Examples of ESSA findings in the past regarding PSEG's information, data and analyses:

- According to ESSA, PSE&G underestimates biomass lost from the ecosystem "… the actual total biomass of fish lost to the ecosystem (including fisheries, station losses, and losses of food to predators, summed over all species) is at least 2.2 times greater than that listed in the Application."[53]
- PSE&G's estimates exclude "a) actual biomass of fish lost at the station for all species including bay anchovy; b) lost prey production other than bay anchovy thereby underestimating catch foregone; and c) the projected increases in RIS abundance in the Application that should be included in estimates of catch and production foregone. The largest under-estimates are for bay anchovy, spot, striped bass, Atlantic croaker and weakfish. Problems with the estimates of natural mortality rates contribute to the underestimation of lost biomass. The difficulties with production foregone imply redoing all dependent and related analyses."[54]
- "The monitoring programs that collected these data often changed in location, timing and methods of sampling. The Application does not include sufficient caveats regarding the impact of these changes, the many assumptions made to transform field measures into model inputs, and the inherent uncertainty in original abundance estimates. We recommend that the current application: 1) list all assumptions made; 2) acknowledge and estimate uncertainty in the data; 3) perform sensitivity analyses to identify what uncertainties have the greatest influence on modeling results; and 4) adjust the conclusions to reflect uncertainties in data, analytical methods, and confounding factors."[55]
- ESSA states "It is judged, however, that the estimated impingement mortality rates are not representative of actual mortality rates of impinged fishes after they are returned to the Delaware river via the fish return system of the station."[56]
- ESSA concluded that "documentation of the uncertainty and potential bias associated with the impingement and entrainment loss estimates, and with the CMR estimates, is important because the results of these analyses provide key input to subsequent analyses of the effects of the station, such as fish stock jeopardy, lost fish production and biomass, assessment of the Base Case Future

[52] ESSA Technologies, ***Review of Portions of New Jersey Pollutant Discharge Elimination System (NJPDES) Renewal Application for the Public Service Electric & Gas' (PSE&G) Salem Generating Station, Final Report***, Prepared for Division of Water Quality, NJDEP, June 14, 2000, p. xi. ("ESSA Report")
[53] ESSA Report p. 75
[54] ESSA Report p. ix
[55] ESSA Report p. x
[56] ESSA Report p. 6

station operations scenario, and ultimately, the cost/benefit analyses of BTA to reduce entrainment and impingement."[57]

- Referring to PSE&G's discussion and presentation of entrainment CMR ESSA found PSE&G's "discussion in this section of the Application to be misleading."[58]
- "Thus, it is judged that the mortality of impinged fish returning to the Delaware River is likely not accurately described by the mortality estimates determined with the sampling pool and holding tanks."[59]
- "In summary, all the natural mortalities (M) for young fishes are likely overestimated, which has direct implications to CMRs if estimated with the EEIM. The CMRs of pre-juvenile 1 stages would be underestimated. The elevated Ms would result in underestimation of production foregone of growing populations, which would directly affect the fisheries benefit analyses of the cost/benefit assessment of alternative technologies to reduce entrainment and impingement."[60]
- " In particular, there is a tendency to draw subjective and unsupported conclusions about the importance of Salem's impact on RIS finfish species."[61]

But, ESSA's report clearly articulates not just a concern about the misrepresentation of data by PSEG, but a concern regarding the impacts of Salem on Delaware Estuary fish populations:

> "It is often concluded that the impact of Salem is "trivial" despite the evidence that there is an impact."[62]

In addition, while there have been enhancements in the health of the Delaware Estuary, species that are adversely impacted by Salem are continuing to suffer – as discussed above, the adverse impacts to these species that are in decline or at depressed population levels gets lost from view in the 10,000 foot characterizations provided by PSEG and NJDEP in the draft permit materials.

Salem is clearly having an adverse environmental impact, regardless of PSE&G's self-serving claims based on faulty scientific studies.

According to a study conducted by a NJDEP hired expert in 1989 as well as experiences at other facilities, installation of cooling towers at Salem would reduce their fish kills by 95%. And dry cooling at Salem could reduce their fish kills by 99%. As a result, NJDEP must issue a permit that requires technology that will reduce Salem's fish kills by 99%.

NJDEP does not need more time or data in order to mandate closed cycle cooling as the most appropriate and defensible exercise of its Best Professional Judgment.

NJDEP asserts on page 64 of its fact sheet that it is "designating the use of the existing modified Ristroph traveling screens with a fish handling system as interim BTA for impingement mortality for the circulating water system until such time as the final impingement and entrainment determination is made based on submission and review of the required study components" articulated in regulation.

[57] ESSA Report p. 6
[58] ESSA Report p. 13
[59] ESSA Report p. 24
[60] ESSA Report p. 31
[61] ESSA Report p. 77
[62] ESSA Report p. 125

NJDEP asserts also that "in order to render an entrainment BTA Determination under the 2014 rule, the permittee is required to comply with" regulations regarding a variety of information submissions. But this is not an accurate reflection of the law, the law is clear that NJDEP can use its BPJ based on the information on the record for a facility like Salem for whom the permit application was submitted prior to 2014 and for whom there will be a final permit by mid 2018.

NJDEP goes on to say that it is "determined that inclusion of a continued intake flow limit in combination with the conduct of the required studies at the circulating water system and the service water system is BTA for entrainment in accordance with best professional judgment". This is really a circular argument, NJDEP says that mandating more studies is best professional judgement when in fact the "best professional judgement" option is intended by the regulations to allow NJDEP to act now, based on the overwhelming information it has already before it on the record.

In the case of Salem, the fish kills are excessive and overwhelming, the level of data and information on the Salem record is also massive, and there is clear information and evidence to document that the most effective best technology available, and very viable economic alternative, for minimizing the impingement and entrainment impacts of the facility is closed cycle cooling.

As a clear demonstration of how the information already on the record is sufficient to demonstrate the significant adverse environmental impacts that will continue to result from Salem should it be allowed to continue to operate with closed cycle cooling, the State of Delaware used this existing information and the NJDEP draft permit scenario to demonstrate the substantial losses Salem will continue to have on the "iconic" striped bass population of the Delaware Estuary and River, and making clear the data demonstrates similar high level losses for other species.

The flow limitation of 3,024 MGD remains a mere paper limitation -- prior to 1994, the first time this limitation was instituted, 3,024 MGD already represented the maximum level at which the Salem plant operated. EPA's 316(b) case study, Figure B2-2, documents that in fact up until 1998 Salem's withdrawals topped out at a mere 2,612 MGD. [63] The design capacity of the facility is 3,200 MGD. The minimal reduction from 3,200 to 3,024 MGD (a mere 176 MGD) was and is not only minimal, but is in fact no reduction in reality, it is a mere reduction on paper as Salem did not historically operate above this level.

Providing PSEG more time to continue to operate business as usual given the excessively high fish kills at the facility and given the large amounts of data on the record collected by PSEG, analyzed by independent consultants commissioned by NJDEP, submitted by experts from other agencies, and provided by organizations like the Delaware Riverkeeper Network (as part of comments of the past and this current comment) is a transparent ploy to take no action.

According to a 1990 review of the Salem facility conducted by Versar, Inc. on behalf of NJDEP, installation of closed cycle cooling at Salem would reduce its fish kills by over 95%.

In 1994, rather than require PSE&G to install closed cycle cooling, or some technology that would reflect the minimization of impacts that closed cycle cooling could achieve, i.e. reducing their fish kills by 95%, NJDEP allowed PSE&G to embark on a series of paper changes, mitigation experiments, studies, and modifications to their operations. None of the actions required reflected a 95% reduction

[63] US EPA, 316(b) Case Studies, Part B: The Delaware Estuary.

in the fish kills inflicted by Salem's cooling water intake structure. In fact, the permit primarily relied on a wetlands mitigation experiment designed to eradicate phragmites using herbicides, burning, mowing and other marsh manipulations to fulfill the requirements of 316(b). Such actions are contrary to the clear letter, intent and history of the Clean Water Act as it pertains to fulfillment of section 316(b) and were rejected by the courts as a means for achieving the 316(b) best technology mandate.

Draft Permit Continues to Allow Compliance with 316(b) Through the use of Special Conditions, in violation of the plain language of the Clean Water Act and the outcome of judicial proceedings.

Allowing the use of special conditions to fulfill the requirements of 316(b) is not an appropriate application of the Clean Water Act (CWA). The CWA requires application of the best technology available to the design, location, construction and capacity of the cooling water intake structures to minimize adverse environmental impact. And yet, for over 20 years, PSE&G has been allowed to comply with section 316(b) of the Clean Water Act largely through application of a series of special conditions including wetlands "restoration", construction of fish ladders and associated fish stocking, and Delaware Bay fish abundance analyses. With this 2015 draft permit, and its continuing emphasis on special conditions to mitigate the adverse impacts of Salem, the use of mitigation measures wholly unrelated to the Salem CWIS perpetuates this illegal approach for complying with 316(b).

The Second Circuit in 2007 made clear that section 316(b) requires a technological approach, and one that is associated with the location, design, construction or capacity of cooling water intake structures for minimizing adverse environmental impacts (i.e. impingement and entrainment). As the court stated:

- "[R]estoration measures contradicts the unambiguous language of section 316(b)."
- "Restoration measures are not part of the location, design, construction or capacity of the cooling water intake structures…."
- "…restoration measures substitute after-the-fact compensation for adverse environmental impacts that have already occurred for the minimization of those impacts in the first instance."

(*Riverkeeper, Delaware Riverkeeper Network, et. al. v. US EPA*, 475 F.3d 83; 2007)

Mitigation or restoration projects, such as those being carried on by PSE&G at its Salem Nuclear Generating Station are not an appropriate or legal way to come into compliance with the 316(b) requirements of the Clean Water Act. According to the second circuit ruling, PSE&G's wetlands mitigation program, its fish ladders, its educational efforts, and its baywide abundance research clearly do not, and cannot, fulfill the requirements of section 316(b) of the Clean Water Act.

The Second Circuit supported that the law requires minimization of the impingement and entrainment impacts of a facility. Modifications to the Salem intake screens, continued operation at a capacity of 3,024 MGD which impinges and entrains over 14 billion fish at various life stages a year, research into bubbles, noise and lights for deterring fish, cannot be said to even come close to the minimization requirements of 316(b). Closed cycle cooling is, by all accounts, the technology that will minimize the impingement and entrainment impacts of Salem's cooling water intake structure – this was the express finding of Versar, Inc. when it considered the facility as a consultant working for NJDEP. Closed cycle cooling is a proved and proven technology available to existing facilities like Salem. It is a technology that can be and should be mandated by the State of New Jersey.

The following are all characterized in the same way, by NJDEP in the Fact Sheet accompanying the draft permit – i.e. as special conditions benefiting the fish populations of the Delaware Estuary:

- The circulating water intake flow volume,
- The flow rate,
- The travelling screen mandate,
- The impingement and entrainment monitoring,
- The wetlands program requirement,
- The fish ladders mandate,
- The artificial reefs requirement,
- The biological monitoring program

Thus, it is clear that all of these provisions are of equal standing in the NJPDES section 316 determinations and mandates. In the permit itself these provisions are all located under Part IV.G. As such, it is clear that NJDEP continues to use mitigation and restoration as a primary means of helping PSEG to meet its CWA 316(b) obligations – an approach which is a violation of the law.

Moreover, since the Department first incorporated the restoration measures into Salem's 1994 NJPDES Permit, it has been clear that those measures were incorporated to comply with section 316(b)'s mandates. Namely, in the Department's own Fact Sheet that supported the 1994 NJPDES Permit it stated:

- "On March 4, 1993, PSE&G filed the 1993 Application Supplement which proposed Special Conditions for a proposed Draft Permit **in support of the Company's request for a BTA determination under Section 316(b)** . . ." See p. 125 of 152 of the June 24, 1993 Fact Sheet (emphasis added).

- "As part of the Company's 1993 Application Supplement, the Company submitted a Technical Appendix which provides the scientific and technical basis for the proposed Special Conditions to the Draft Permit **for resolution of . . . the Department's Section 316(b) BTA determination**." See p. 125 of 152 of the June 24, 1993 Fact Sheet (emphasis added).

All of the Special Conditions, including the wetland restoration measures, the construction of fish ladders, and Delaware Bay fish abundance analyses, were received with the understanding that they were to be considered as a part of the Department's 316(b) analysis. See p. 125-134 of 152 of the June 24, 1993 Fact Sheet. Thus, these unbiased statements by the Department demonstrate it evaluated these restoration measures as a part of its 316(b) assessment.

We would also like to note, in light of the claim that these special conditions would mitigate for the adverse fish impacts inflicted by Salem, that claim has so far proven false. See for example the findings of Evaluation of Special Conditions Contained in Salem Nuclear Generation Station NJDPES Permit to Restore Wetlands, Install Fish Ladders, and Increase Biological Abundance Within the Delaware Estuary[64] undertaken in 2003 in which it was determined, based upon PSEG provided data,

[64] Evaluation of Special Conditions Contained in Salem Nuclear Generation Station NJDPES Permit to Restore Wetlands, Install Fish Ladders, and Increase Biological Abundance Within the Delaware Estuary , Carpenter Environmental Associates, 2003

that the program had not in fact mitigated for the impacts of Salem or enhanced the quality and quantity of fish in the Delaware Estuary.

October 3, 1990 NJDEP determined that the best technology available for minimizing adverse environmental impact at Salem was closed cycle cooling. They based this decision largely upon the input and findings of their hired expert, Versar Inc. It is time to reinstitute this decision for Salem.

The uses the draft permit seeks to protect fail to consider the existence of existing uses that exceed the designated uses of the Delaware River.

The NJDEP fact sheet asserts that the following uses of zone 5 need to be protected:

- Industrial water supplies after reasonable treatment
- Maintenance of resident fish and other aquatic life
- Propagation of resident fish from R.M. 70 to R.M. 48.2
- Passage of anadromous fish
- Wildlife
- Recreation
- Navigation

This characterization of uses to be protected fails to recognize that in the Delaware Estuary, in many ways, existing uses exceed designated uses and as such the level of protection required is higher as per the anti-degradation mandates of the Clean Water Act.

Attached find a petition submitted by the Delaware Riverkeeper Network, Delaware River Shad Fishermen's Association, and the Lehigh Stocking Association, documenting how the existing using of the Delaware estuary exceed designated uses, and therefore the level of protection required of PSEG and its Salem facility are higher than articulated in the NJDEP fact sheet. In addition, attached find a draft DRBC report documenting, with a higher level of specificity, some of the specific ways that existing uses for particular species exceeds designated uses.[65] Please note, the DRBC document is merely a draft, and so also attached are comments from the Delaware Riverkeeper Network articulating deficiencies in the draft report we anticipate being corrected in future iterations.

As recognized in the Delaware Riverkeeper Network, Delaware River Shad Fishermen's Association, and the Lehigh Stocking Association petition:

1) designated uses of Zones 3, 4, and River Miles 78.8 to 70.0 of Zone 5 to must be upgraded to include the existing use of propagation of resident fish and other aquatic life;

2) designated uses of Zones 2 through 5 must be updated to include the exists uses of spawning and nursery habitat for anadromous fish; and

Atlantic sturgeon, American Shad, Striped Bass, White Perch, Bay Anchovy, Atlantic Silverside, Alewife, Blueback Herring and Menhaden are all among the species discussed in the DRBC Existing Use Evaluation and are all among the species being significantly impacted by Salem. Pursuant to the

[65] DRBC, ***Existing Use Evaluation for Zones 3, 4, 5 of the Delaware Estuary, draft report***, March 24, 2015.

anti-degradation mandates of the Clean Water Act, the obligation to protect these species is greater than described in NJDEP's documentation supporting its draft permit proposal.

Furthermore, as has been properly noted in the Delaware Riverkeeper Network et. al. petition as well as the DRBC Draft Existing Use Evaluation, dissolved oxygen levels are a focal point for evaluation of the enhancements to estuary fish populations as well as an ongoing limitation.

As noted by Dr. Danielle Kreeger of the Delaware Estuary Partnership:

> *"Kreeger said that even with temporary warming of the water, that warmer water holds less oxygen so she and others are starting to see more instances in the upper estuary where dissolved oxygen in the water drops. When it gets too low, fish that can't swim away fast enough, often schooling fish like mehanden, die.*
>
> *And warmer, saltier water can mean outbreaks of Dermo, an oyster disease caused by the pathogen Perkinsus marinus, and is common in the Delaware and Chesapeake bays."*[66]

Salem is an ongoing source of super heated water to the Estuary. The discharge of heat from Salem, individually as well as cumulatively with anticipated warming from climate change, and the implications for Atlantic Sturgeon, for estuary oysters, and for other species is not evaluated, considered or addressed in this draft permit in any meaningful way; an agency using best professional judgment would not allow for such a substantial oversight.

PSEG has also proposed construction of an additional Nuclear Power Plant on Artificial Island – commonly referred to as Salem 4. Salem 4 will be another source of impingement, entrainment and heated cooling water discharge. The implications of Salem 4 cumulatively with Salem 1 & 2, as well as Hope Creek, in this stretch of the Delaware River, further support the best professional judgment determination of closed cycle cooling at Salem.

Continuing to grant a variance from DRBC temperature standards is not legally defensible.
Since 1977 Salem has been allowed to operate under a variance from DRBC's temperature standards. It is inappropriate to allow Salem to continue to operate in exceedence of DRBC's temperature standards given that (1) it has been over 20 years since DRBC granted this variance and conditions in the Delaware River have changed significantly;[67] (2) climate change is causing, and will continue to cause, increased temperature increases in the Delaware Estuary that magnify the adverse impact of the temperature increase caused by Salem; (3) the cumulative impact of Salem, climate change and/or an anticipated new nuclear power plant on Artificial Island called Salem 4, will likely contribute to increased mortality of aquatic life in the Delaware Estuary and the variance ignores the significance of this adverse impact.

As noted in the ECONorthwest expert report attached to this comment:

> "the average temperature increase at the [Salem] discharge is from 8 to 10 °F (4 to 6 °C).[68] The Delaware River Basin Commission (DRBC) temperature standards for Water Quality Zone 5 of

[66] Wetland loss the issue in Delaware Bay, **The News Journal**, *September 5, 2015*
[67] Carpenter Environmental Associates, ***Review and Analysis of the Salem Generating Station's Draft New Jersey Department of Environmental Protection (NJDEP) New Jersey Pollutant Discharge Elimination System (NJPDES) Discharge to Surface Water (DSW) Permit NJ0005622 Renewal for The Salem Generating Station in Lower Alloways Creek Township, Salem County, New Jersey***, Sept. 2015.
[68] U.S. Nuclear Regulatory Commission. 2011. *Essential Fish Habitat Assessment - Salem Nuclear Generating Station Units 1 and 2 Hope Creek Generating Station*. Available online at: http://pbadupws.nrc.gov/docs/ML1103/ML110320668.pdf

> the Delaware Estuary (where the Salem discharge is located) state that the temperature in the river may not be raised above ambient by more than 4 degrees Fahrenheit (°F; 2.2 degrees Celsius [°C]) during non-summer months (September through May) or 1.5°F (0.8°C) during the summer (June through August). However, Salem has received a variance and has been exempt from these temperature standards since it began operation in 1977.[69] Salem's thermal plume under the Baseline Scenario is likely to contribute to increased mortality as water in the Delaware River increases in temperature due to climate change."

The temperature exceedences at Salem have adverse impacts on a variety of fish species; as well stated by ECONorthwest:

> "Effluent from Salem regularly exceeds the Delaware River Basin Commission's water quality regulations for temperature …. Thermal impacts from Salem occur during seasons of particular importance for critical life stages, and temperatures within the plume exceed thresholds for the spawning of federally-listed species including Shortnose sturgeon and Atlantic sturgeon. Other important species have similar potential effects of elevated water temperatures including American shad, white perch, and striped bass. Temperatures are also outside of optimal for other life stages of these fish species as well as channel catfish, bluegill and others.

NJDEP and DRBC should not continue in place the variance from temperature standards that allows these adverse impacts to continue, and doing so fails to fulfill the mandates of 316(a).

Furthermore, pursuant to section 316(a) of the Clean Water Act and implementing regulations, the NJDEP should issue a draft permit that mandates closed cycle cooling at Salem.

Under section 316(a) of the Clean Water Act, NJDEP may provide Salem a water quality variance for its thermal discharges only if the variance will assure the protection and propagation of a balanced, indigenous population ("BIP") of shellfish, fish, and wildlife in and on the Delaware River. Because Salem and NJDEP failed to consider important aspects of the thermal variance issue, including (but not limited to)[70], failing to calculate the extent of the lateral, downriver and upriver surface and subsurface temperature profiles for the modeled thermal plumes and failing to utilize the most recent (2004-14) USGS temperature data, they have not sufficiently demonstrated that BIP are adequately maintained. Thus, NJDEP's grant of thermal variance to Salem would be arbitrary, capricious and/or unreasonable. NJDEP must withdraw its thermal variance in order to comply with its mandate to fully and properly apply DRBC regulatory mandates that apply.

The cost of installing cooling towers, given the economic, recreational, and other benefits, is well justified.

The NJPDES draft permit fact sheet asserts the cost of retrofitting to natural draft cooling towers is an estimated $852,440,200 and that the capital cost for retrofitting with mechanical draft cooling towers is an estimated $814,844,200. As demonstrated in the attached report by ECONorthwest, the costs of

[69] NOAA National Marine Fisheries Service. 2014. *Endangered Species Act Section 7 Consultation Biological Opinion - Continued Operation of Salem and Hope Creek Nuclear Generating Stations NER-2010-6581*. Available online at: https://www.greateratlantic.fisheries.noaa.gov/protected/section7/bo/actbiops/salemhcnmfsfinalbiopjuly172014.pdf

[70] See the attached Carpenter Environmental report for a full account of deficiencies, Carpenter Environmental Associates, ***Review and Analysis of the Salem Generating Station's Draft New Jersey Department of Environmental Protection (NJDEP) New Jersey Pollutant Discharge Elimination System (NJPDES) Discharge to Surface Water (DSW) Permit NJ0005622 Renewal for The Salem Generating Station in Lower Alloways Creek Township, Salem County, New Jersey***, Sept. 2015.

installing closed cycled cooling at Salem are affordable, and are not wholly disproportionate to or significantly greater than their resulting environmental benefits.[71]

The annual economic value of the Delaware River Basin is nearly $22 billion with 1.54 billion of that being ascribed to fish and wildlife activities.[72]

The market value of commercial and recreational fishing in the Delaware River has been estimated as $610 million with an additional recreational value of $76 million attributable to fishing.[73]

"Fishing, hunting, and bird watching/wildlife associated recreation employ 44,941 jobs with $1.5 billion in wages in the Delaware Basin including:

- Delaware (4,080 jobs earning $134 million in wages)
- New Jersey (17,477 jobs earning $574 million in wages)
- New York (4,872 jobs earning $160 million in wages)
- Pennsylvania (18,512 jobs earning $608 million in wages)" [74]

As the Marine Recreational Fisheries Statistics Survey demonstrated, fishing the Delaware is a highly prized activity – providing high levels of enjoyment as well as economic values to the region. On average, anglers in our region spend $62.43 to $100.24 for single and multiple day trips catching millions of pounds of striped bass, weakfish, flounder, bluefish, atlantic croaker, tautog, spot, white perch and more.

The benefits of protecting and enhancing the health and number of fish in the Delaware Estuary is significant and well comparable, economically and otherwise, with the cost of mandating closed cycle cooling at Salem.

The attached report by ECONorthwest describes how much economic value would be generated by cooling towers even without including all of the benefits that can and should be included in such a calculation but was not by PSEG, NJDEP or EPA. In addition, the attached report documents the many ways that closed cycle cooling is demonstrably affordable to PSEG and Exelon, the owners of Salem. For example:

- ✓ "for the fiscal year ending December 31, 2014, PSEG's annual operating revenues were $5.4 billion. … for the fiscal year ending December 31, 2014, Exelon's operating revenues were $17.4 billion." And so, the annual amortized cost of closed cycle cooling at Salem would represent a mere 0.3 percent of PSEG and Exelon's combined annual operating revenues.

- ✓ "The total installed cost of [closed cycle cooling at Salem] ($852 million) represents about 31 percent of the companies [PSEG & Exelon, Salem's owners] combined annual capital expenditure, and the annual loan payment just 2 percent." [75]

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[71] **ECONorthwest,** Economic Benefits of Installing a Closed-Cycle Cooling System at Salem Nuclear Generating Station, Final Report, **Sept, 2015**

[72] Gerald J. Kaufman, **Socioeconomic Value of the Delaware River Basin in Delaware, New Jersey, New York, and Pennsylvania,** *The Delaware River Basin, an economic engine for over 400 years,* Final Draft May 25, 2011.

[73] Kaufman, Socioeconomic Values of the Delaware River Basin, University of Delaware.

[74] Kaufman, Socioeconomic Values of the Delaware River Basin, University of Delaware.

[75] **ECONorthwest,** Economic Benefits of Installing a Closed-Cycle Cooling System at Salem Nuclear Generating Station, Final Report, **Sept, 2015.**

In addition, to the extent PSEG and Exelon pass the costs on to the public, they are passing on a cost that is quite low considering the high level benefits to be achieved, e.g.[76]

- ✓ Installing closed cycle cooling at Salem "would increase electricity rates by $0.0036 per kWh".
- ✓ If the costs of closed cycle cooling were passed on to residential customers of Salem the potential increase in electricity costs is only about $26 per customer per year (for NJ customers it is likely to be lower given deregulation of NJ's energy market).

These costs are particularly small when considered in comparison to the benefits the public will receive, and in comparison to the public's willingness to pay for environmentally beneficial and protective energy options as discussed in the ECONorthwest report attached.

PSE&G has successfully evaded compliance with the law for over 4 decades. NJDEP and the current administration have the opportunity to change this illegal course of conduct and to reign PSE&G into compliance with the law.

Respectfully,

Maya K. van Rossum
the Delaware Riverkeeper

Attachments:

ECONorthwest, Economic Benefits of Installing a Closed-Cycle Cooling System at Salem Nuclear Generating Station, Final Report, **Sept, 2015.**

Carpenter Environmental Associates, ***Review and Analysis of the Salem Generating Station's Draft New Jersey Department of Environmental Protection (NJDEP) New Jersey Pollutant Discharge Elimination System (NJPDES) Discharge to Surface Water (DSW) Permit NJ0005622 Renewal for The Salem Generating Station in Lower Alloways Creek Township, Salem County, New Jersey,*** Sept. 2015.

Plus all documents referenced in footnotes.

[76] **ECONorthwest,** Economic Benefits of Installing a Closed-Cycle Cooling System at Salem Nuclear Generating Station, Final Report, **Sept, 2015.**