NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

In the Matter of a Renewal and Modification of a State Pollutant Discharge Elimination System ("SPDES") Permit Pursuant to article 17 of the Environmental Conservation Law And Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York parts 704 and 750 *et seq.* by Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC, Permittee,	**DEC # 3-5522-00011/00004** **SPDES # NY-0004472**
-and-	
In the Matter of the Application by Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC, And Entergy Nuclear Operations, LLC for a Certificate Pursuant to §401 of the Federal Clean Water Act.	**DEC # 3-5522-00011/00030** **DEC # 3-5522-00011/00031**

REBUTTAL TESTIMONY OF DR. FRANK ACKERMAN REGARDING PERMANENT FISH PROTECTION OUTAGES AT INDIAN POINT ENERGY CENTER ON BEHALF OF INTERVENORS RIVERKEEPER, INC., SCENIC HUDSON, INC., AND NATURAL RESOURCES DEFENSE COUNCIL, INC.

August 10, 2015

Q. What is the purpose of your rebuttal testimony?

A. The purpose of my testimony is to respond to the direct testimony of Department of Environmental Conservation (DEC) witness William Charles Nieder and of Entergy witnesses David Harrison and Eugene Meehan regarding the evaluation of permanent fish protective outages as best technology available (BTA) for cooling water intake systems (CWIS) at Indian Point Units 2 and 3 (collectively, Indian Point or IPEC). Specifically, I will respond to their discussions of the "wholly disproportionate" test, as applied to permanent fish protective outages, and to Dr. Harrison's and Mr. Meehan's treatment of the balancing of social and environmental considerations under New York's State Environmental Quality Review Act (SEQRA).

Q. Please identify the testimony and reports which you have reviewed in connection with your rebuttal testimony.

A. I have reviewed the following testimony and reports:

- June 2015 direct testimony of Dr. Harrison and Mr. Meehan
- The NERA report referenced by Harrison and Meehan, "Economic Analyses of Permanent Mandatory Summertime Outages at IPEC" (June 2015) (**Entergy Exhibit 579**)
- NERA, "Benefits and Costs of Cylindrical Wedgewire Screens at Indian Point Energy Center" (March 2013) (**Entergy Exhibit 185**)
- June 2015 direct testimony of Mr. Nieder
- Mr. Nieder's amended report on the wholly disproportionate test (June 26, 2015) (**Staff Exhibit 304**)
- June 2015 direct testimony of Dr. Peter Henderson
- September 2011 rebuttal testimony of Dr. Henderson
- June 2015 direct testimony of Mr. Robert Fagan

- June 2015 direct testimony of Mr. Paul Blanch
- June 2015 direct testimony of Mr. John Hinckley

Q. Has reviewing the testimony of Dr. Harrison and Mr. Meehan and their accompanying 2015 NERA report in any way changed your opinion as expressed in your direct testimony with respect to the BTA costs and the SEQRA economic effects of fish protection outages?

A. No, it has not.

Q. Please compare the outage scenarios considered by Mr. Nieder and Dr. Harrison and Mr. Meehan to the Riverkeeper outage scenario which you analyzed in your direct testimony.

A. Mr. Nieder evaluates four outage scenarios: 42 or 62 annual outage days at both units; and 42 or 62 outage days at one unit with closed cycle cooling at the other. Dr. Harrison and Mr. Meehan also consider four scenarios: either 42 or 62 annual outage days at both units, with the two units' outage dates either simultaneous or staggered. In my direct testimony I analyze the outage proposal made by Riverkeeper, calling for an annual total of 118 fish protective outage days at both units. As discussed below, none of these witnesses evaluated or analyzed Riverkeeper's 118-day outage proposal, despite having full knowledge of Riverkeeper's proposed outage scenario, and Riverkeeper therefore reserves its rights to respond to any such evaluation or analysis that may be set forth in any pre-filed rebuttal testimony by any witness.

I. BTA Fourth Step Rebuttal

Q. Do the DEC and Entergy witnesses address Riverkeeper's 118-day outage proposal and the issue of Atlantic tomcod entrainment?

A. Mr. Nieder discusses the Atlantic tomcod issue at some length (Nieder direct, 17:7 – 22:2), but asserts that "we simply do not have a good estimate of the number of tomcod

that are entrained annually at IPEC" (Nieder direct, 18:9-10). He does not develop any proposals specifically aimed at reducing (let alone minimizing) tomcod entrainment, and does not mention Riverkeeper's 118-day outage proposal.

Dr. Harrison and Mr. Meehan mention the Riverkeeper proposal in passing (Harrison-Meehan direct, 3:1-3), but state that they will discuss it only qualitatively because it "would be even worse" than the 62-day outage proposal which they reject (Harrison-Meehan direct, 4:5-11). They conclude, without any quantitative analysis of 118-day outages, that "... [118-day outage] costs would by definition be wholly disproportionate" (Harrison-Meehan direct, 46:1-8). Harrison and Meehan do not mention the tomcod issue at any point in their direct testimony or accompanying report (**Entergy Exhibit 579**).

Q. What is your evaluation of the comparison of BTA options by the DEC and Entergy witnesses?

A. Several BTA options are discussed by Mr. Nieder and by Dr. Harrison and Mr. Meehan. However, only two options that have been discussed in this case would achieve the level of entrainment reduction required for BTA under CP-52. One BTA option is an annual fish protective outage, for at least the 118 days at both units proposed by Riverkeeper (a longer outage, the 32 week proposal by Riverkeeper, would also qualify); the second BTA option is closed-cycle cooling at both units.

The proposal of closed-cycle cooling at both units is the preferred BTA alternative for both DEC (see Nieder direct, 29:21-22) and Riverkeeper, as I understand, and has a proportional cost of approximately 10% according to Mr. Nieder's calculations (**DEC Staff Exhibit 304**, Table 8, p.20-21).

Mr. Nieder's calculations make clear the failure of other proposals to meet the equivalent performance standard of the BTA Step 4 wholly disproportionate analysis, as summarized in Table 8, p.20-21, of his "Amended Wholly Disproportionate Test Report with Outages" (**DEC Staff Exhibit 304**).

One of DEC's scenarios, a 62-day outage at one unit combined with closed-cycle cooling at the other, comes close to the required performance standard in CP-52 (id.). But as I have noted, DEC's calculations do not address the critical effects of Indian Point's CWIS on the Atlantic tomcod, and therefore, as Dr. Henderson explained (see Henderson direct, 11:11-14; 12:19-24), none of DEC's outage scenarios are appropriate BTA alternatives.

Thus, Riverkeeper's proposed 118-day outage scenario remains the only site-specific, available BTA alternative discussed in this case (other than closed-cycle cooling or 32-week outages) that meets the performance standard of CP-52 (see CP-52, p.3). As I explained in my direct testimony, the proportionate costs of the 118-day outage scenario are not wholly disproportionate to the environmental benefits from minimizing Indian Point's established adverse environmental impact by way of such outages.

Q. Please describe Dr. Harrison's interpretation and use of so-called "social costs" in his BTA analysis.

A. In Dr. Harrison's analysis, the "social costs" of fish protective outages are defined as the changes in Indian Point's capital costs, net operations and maintenance costs, and the costs of replacement power; in practice, the costs of replacement power are by far the largest component of his "social costs" (see **Entergy Exhibit 579**, Executive Summary p. E-13, and Appendix H).

Dr. Harrison uses what he calls "social costs" – largely the costs of replacement power – to develop benefit-cost ratios, such as the number of organisms saved per dollar of "social cost", or the number of age-1 equivalent organisms saved per dollar of "social cost" (see, for example, **Entergy Exhibit 579**, Table E-11, p. E-14). Discussion of these benefit-cost ratios appears to take the place, in his analysis, of the proportionate-cost calculations of the BTA fourth step of the wholly disproportionate analysis. The simplicity and transparency of DEC's proportionate-cost approach is lacking in Dr. Harrison's development of benefit-cost ratios, which depend on numerous intricate and potentially controversial data and assumptions. As I explained in my direct testimony, DEC's methodology is a straight-forward, consistent, and transparent methodology to cacluate the proportional costs and benefits of a proposed BTA. Dr. Harrison's methodology adds needlessly complex benefit-cost ratios, which complicate the calculation far beyond what would be expected of a non-economist who may undertake such calculations (such as a DEC biologist or permit specialist) or try to understand them (such as the general public).

Q. Please explain Dr. Harrison's so-called "cumulative analysis" which he employs in in his BTA calculations.

A. Dr. Harrison undertakes what he calls a "cumulative analysis" as part of his BTA calculation (see Harrison-Meehan direct, 38-42, Tables 5-8). When addressing the operation of Indian Point, Dr. Harrison assumes that ten years of preparation will be required before any fish protective outages can be scheduled. According to Dr. Harrison, the first such outages, in his opinion (and apparently in reliance on Entergy's engineering witnesses), could not occur until 2026 at Unit 3 and 2027 at Unit 2 (Harrison-Meehan

direct, 38:6-12). Therefore, he argues that fish protective outages will not produce any immediate reduction in impingement and entrainment at Indian Point during that 10 year period. Dr. Harrison's so-called "cumulative analysis" biases his results against fish protective outages (as is explained in detail in the SEQRA response section below).

I understand from the testimony of Riverkeeper Witness Paul Blanch that Indian Point has had hundreds of unit shutdowns, for various reasons, and for time frames of up to one year, over its operating lifetime. According to Mr. Blanch, no additional staff or resources are required to do a voluntary (non-refueling) shutdown of a nuclear unit, such as is being proposed with seasonal fish protection outages. Consequently, I do not understand how ten years of planning could be necessary before the fish protection outages could be implemented at Indian Point.

As Riverkeeper witness Dr. Henderson previously explained in response to Entergy witness Dr. Barnthouse's similar "Cumulative Benefits Analysis":

> This form of analysis is highly dependent on the assumptions made and these assumptions are not scientifically based. Using the concept of Cumulative Benefits Analysis, it would be possible to make any technology appear to be more beneficial than another because under the analysis, the level of benefit that accrues depends on the length of time before installation of each of the technologies.[1]

Since I understand that DEC has the authority to include interim compliance measures in its SPDES permit, Dr. Harrison's "cumulative" analysis, even if it were valid, omits an

[1] Henderson September 30, 2011 Rebuttal to Dr. Barnthouse at 5:12-16.

important category of environmental benefits (necessary and requisite interim measures) from fish protective outage scenarios.

II. SEQRA Rebuttal

Q. Do you have any comments on other witnesses' discussion of the balancing of social and economic considerations under SEQRA?

A. Mr. Nieder says very little about SEQRA balancing. Dr. Harrison and Mr. Meehan address SEQRA balancing almost exclusively with a cost-benefit analysis. Indeed, in their accompanying report, the section on SEQRA is titled "SEQRA Cost-Benefit Analysis" (**Entergy Exhibit 579**, p.57). Their analysis compares their estimates of lost generation revenue, or the costs of replacement power, to "theoretical benefits," i.e. monetized estimates of the value of fish saved by outages (Harrison-Meehan direct, 47:5-49:12). Their accompanying report (**Entergy Exhibit 579**) also expresses "theoretical benefits" in terms of numbers of organisms and age-1 equivalents, but the quantitative summary of costs and benefits in the testimony (Harrison-Meehan direct, Table 10, 50:1) refers only to monetized values of fish saved.

Q. Is a cost-benefit analysis required or useful under SEQRA in your opinion?

A. No. As I explain in my direct testimony, there is no requirement for cost-benefit analysis or monetization of benefits under SEQRA. Indeed, balancing of social and economic considerations under SEQRA, if appropriate, occurs in the final stages of the proceeding, after the selection of a BTA option.

The Harrison-Meehan cost-benefit analysis does not even provide a useful supplemental perspective on the questions addressed under SEQRA. Rather, it is based on assumptions

which trivialize the biological benefits of any BTA measures at Indian Point. The NERA report values the cumulative benefits of fish protective outages through 2035 at a present value of only $2.2 - $4.4 *million*, compared to "social costs" for replacement power of more than $1 *billion* (**Entergy Exhibit 579**, Table E-14, p. E-17).

The report accompanying the Harrison-Meehan testimony barely describes the fish valuation methodology that leads to such low values, instead referring to an earlier NERA report where the methodology was explained (NERA, "Benefits and Costs of Cylindrical Wedgewire Screens at Indian Point Energy Center," (March 2013), **Entergy Exhibit 185**). As the earlier report makes clear, NERA assigns monetary value only to commercially and recreationally harvested fish, and to the forage fish consumed by the harvested fish (see **Entergy Exhibit 185**, Section IV, p. 14-27, describing benefits methodology, and Table 14, p. 31, summarizing categories of monetized and non-monetized benefits). In short, the only fish with monetary value in this approach are the ones that people would have caught, commercially or recreationally, or the ones that were eaten by the ones that would have been caught. All the fish that got away – the ones that lived another year, or were eaten by ones that survived – are worth exactly nothing in NERA's method of valuation.

Thus, the Harrison-Meehan SEQRA cost-benefit analysis is neither reliable nor helpful to the balancing under SEQRA, and actually presents an incomplete and misleading scenario.

Q. Do Dr. Harrison and Mr. Meehan present an accurate picture of the social and economic consequences of fish protective outages?

A. No, they do not. They present a lengthy discussion of the costs of replacement power and the associated economic and environmental effects (Harrison-Meehan direct, 24:1-33:19). As mentioned in my direct testimony, however, the testimony of Riverkeeper witnesses Robert Fagan and John Hinckley demonstrates that there would not be any significant undue adverse impacts of fish protective outages on either the electrical system or air quality. For example, Mr. Fagan's direct testimony shows that any slight increases in electricity prices in the near term would be mitigated in the long term by the availability of new supply and demand-side resources, and by increases in transmission capacity (Ackerman direct 21:12-19, citing Fagan direct 16:19 – 19:31). Paralleling the problem associated with the "cumulative analysis" in their BTA calculations (see discussion above), the Harrison-Meehan discussion of social and economic impacts under SEQRA gives undue weight to short-term economic effects and insignificant air quality and electric system impacts, thereby exaggerating the costs of replacement power.

Q. In what way do Dr. Harrison and Mr. Meehan give undue weight to short-term impacts of protective outages?

A. When addressing the operation of Indian Point, Dr. Harrison and Mr. Meehan assume that ten years of preparation will be required before any fish protective outages can be scheduled. The first such outages, in their opinion, could not occur until 2026 at Unit 3 and 2027 at Unit 2 (Harrison-Meehan direct, 38:6-12). When calculating the costs of replacement power, in contrast, they assume that costs start in 2016. This asymmetry of scheduling exaggerates the costs of replacement power, relative to the benefits of fish protective outages: it inappropriately uses the much higher, immediate costs of

replacement power as a "proxy" for the lower, future costs at the time of their projected outage.

Q. Do Dr. Harrison and Mr. Meehan explain the scheduling of replacement power costs ten years before they believe the outages could begin?

A. In the report accompanying their testimony, Dr. Harrison and Mr. Meehan state that although the testimony of other Entergy witnesses suggests that fish protective outages could not begin until the mid-2020s,

> ...we model electricity system impacts of [outages] during the five-year period from 2016 to 2020. Predicting the nature of the electricity systems in New York and in the other relevant energy regions a decade hence into the mid-2030s would be uncertain... therefore, we have chosen to adopt a "proxy" approach. We model the near-term annual impacts of the [outages] and use the various annual results to provide assessments of the potential impacts ... over the period from 2026 to 2035 (**Entergy Exhibit 579**, p. 5).

Q. What is wrong with this "proxy" approach?

A. Many of the economic effects of replacing Indian Point power, as analyzed by Dr. Harrison and Mr. Meehan, are greater in the short run, and then decline over time. For example, in their estimate of capacity market impacts (Harrison-Meehan direct, Table 4, at 16:25), all options except "no replacement" have rapidly declining costs from 2016 through 2020. The same is true for their calculation of New York state consumer power expenditures (Harrison-Meehan direct, Table 2 [sic; should be 5], at 27:15-16). For New York City NO_x impacts (Harrison-Meehan direct, Table 6, at 29:1), and New York State SO_2 impacts (Harrison-Meehan direct, Table 7, at 29:2), all options including "no replacement" also have rapidly dropping emissions from 2016 through 2020.

Thus if Dr. Harrison and Mr. Meehan had assumed that the rest of the electric system required several years to adjust to the planned fish protective outages, they would have

estimated much lower economic effects in multiple categories. Even by 2020, as I have just shown, their own calculations show sharp reductions in several categories of economic effects.

Q. Please summarize the bias resulting from assumptions about timing in the analysis of Dr. Harrison and Mr. Meehan.

A. As I have explained above, the Harrison-Meehan analysis makes asymmetrical assumptions about the need for advance planning, imparting a bias to their results. On the one hand, fish protective outages allegedly cannot be started for another decade, limiting their immediate benefit. On the other hand, the economic effects of outages are modeled as if starting immediately, leaving no time for the electric system to adjust and mitigate the costs of replacement power. Such an asymmetrical analysis does not present a realistic or accurate picture of potential "economic and social considerations," and is not helpful to the Tribunal's SEQRA decisionmaking, contrary to the claims of these Entergy witnesses.

With a symmetrical approach to this issue of timing, Dr. Harrison and Mr. Meehan would have concluded either that there are greater benefits to protective outages, since those outages could start immediately – or that there are smaller costs to replacement power, since there are several years available for advance planning.

Q. In your opinion, is it appropriate to include the costs of bringing replacement power plants on line in the SEQRA balancing of social and economic considerations?[2]

A. Analysis of replacement power scenarios leads to many subtle and purely economic questions that are potentially far removed from the reasonably anticipated social effects of fish protective outages. In my opinion, it is preferable to avoid such questions by restricting the SEQRA balancing analysis to the reasonably anticipated (rather than speculative) effects of the action in question. The amount which individuals or firms may decide to spend on constructing or modifying replacement power plants for Indian Point would not be a social cost, but a private investment, presumably based upon a business plan to make a profit for the investor(s).

If a significant amount of replacement power is required, private enterprises will generate that power, investing in additional power plants if needed, and will make a profit on their increased generation. It is not possible to know in advance which companies will sell the replacement power or make the necessary investments; there is nothing to prevent Entergy itself from selling replacement power during fish protective outages at Indian Point, either from Entergy's existing power plants, or by building or acquiring new plants. (Note that I am offering this as a logical possibility, not a prediction of a specific scenario.)

Should the profits of another enterprise that generates replacement power be counted as a cost, for SEQRA purposes? Is it possible to know in advance what new investments in

[2] See Harrison and Meehan June 26, 2015 Outages Direct at 51:14-15.

power plants will be required, and how large the resulting profits will be? Does it matter whether Entergy itself is selling the replacement power? These dilemmas can be avoided by restricting the scope of the SEQRA analysis to include only the reasonably anticipated social and economic effects of the specific action at issue (in this case, outages at Indian Point), rather than attempting complex macroeconomic forecasting of speculative consequences.

Q. Does this conclude your rebuttal testimony?

A. Yes.

Updated Bibliography

Blanch June 26, 2015 Direct Testimony.

Fagan June 26, 2015 Direct Testimony.

Harrison and Meehan June 26, 2015 Direct Testimony.

Henderson June 26, 2015 Direct Testimony.

Henderson September 30, 2011 Rebuttal Testimony (to Dr. Barnthouse).

Hinckley June 26, 2015 Direct Testimony.

NERA, "Benefits and Costs of Cylindrical Wedgewire Screens at Indian Point Energy Center" (March 2013), **Entergy Exhibit 185**.

NERA, "Economic Analyses of Permanent Mandatory Summertime Outages at IPEC" (June 2015), **Entergy Exhibit 579**.

Nieder June 26, 2015 Direct Testimony.

Nieder, "Indian Point Energy Center Unit 2 and Unit 3 BTA Analysis Step Four of the BTA Procedure: The Wholly Disproportionate Test – Amended Wholly Disproportionate Test Resort With Outages" (Updated June 26, 2015), **Staff Exhibit 304**.