

**UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION**

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

_____)	Docket Nos. 50-247-LR and
In the Matter of)	50-286-LR
ENTERGY NUCLEAR OPERATIONS, INC.)	
(Indian Point Nuclear Generating Units 2 and 3))	
_____)	November 21, 2012

**SUPPLEMENTAL TESTIMONY OF ENTERGY WITNESS GEORGE S. TOLLEY
REGARDING CONTENTION NYS-17B (PROPERTY VALUES)**

William B. Glew, Jr., Esq.
William C. Dennis, Esq.
ENTERGY SERVICES, INC.
440 Hamilton Avenue
White Plains, NY 10601
Phone: (914) 272-3202
Fax: (914) 272-3205
E-mail: wglew@entergy.com
E-mail: wdennis@entergy.com

Kathryn M. Sutton, Esq.
Paul M. Bessette, Esq.
Jonathan M. Rund, Esq.
MORGAN, LEWIS & BOCKIUS LLP
1111 Pennsylvania Avenue, NW
Washington, DC 20004
Phone: (202) 739-3000
Fax: (202) 739-3001
E-mail: ksutton@morganlewis.com
E-mail: pbessette@morganlewis.com
E-mail: jrund@morganlewis.com

COUNSEL FOR ENTERGY NUCLEAR
OPERATIONS, INC.

TABLE OF CONTENTS

	Page
I. Witness Background	1
II. Background and Summary of Supplemental Testimony	2
III. Dr. Sheppard Erroneously Claims That Alternative Hedonic Functional Forms Are Consistent with His Repeat-Sales Analysis	11
IV. Dr. Sheppard's Alterations to His Repeat-Sales Analysis Fail to Cure the Major Flaws Dr. Tolley Raised in March 2012	21
V. Conclusion	30

**UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION**

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	Docket Nos. 50-247-LR and
ENTERGY NUCLEAR OPERATIONS, INC.)	50-286-LR
(Indian Point Nuclear Generating Units 2 and 3))	
	November 21, 2012

**SUPPLEMENTAL TESTIMONY OF ENTERGY WITNESS GEORGE S. TOLLEY
REGARDING CONTENTION NYS-17B (PROPERTY VALUES)**

I. WITNESS BACKGROUND

Q1. Please state your full name.

A1. (GST) My name is George S. Tolley.

Q2. By whom are you employed and what is your position?

A2. (GST) I am President of RCF Economic & Financial Consulting, Inc., an economic and financial consulting firm that employs a number of internationally-renowned economists. In addition, I am a Professor Emeritus of Economics at the University of Chicago, where I teach courses in urban economics, environmental economics, and energy policy.

Q3. Have you been involved in the economic evaluation of environmental amenities and disamenities?

A3. (GST) Yes. I have been a practicing economist for more than 50 years and am well-versed in the economic techniques used to evaluate amenities and disamenities, including in hedonic and repeat-sales analyses. In fact, I have authored or co-authored some of the seminal economic publications in this area. *See, e.g., Curriculum Vitae* of George S. Tolley (ENT000143) (publication numbers 1.39, George S. Tolley & Alan S. Cohen, *Air Pollution and*

Urban Land-Use Policy, 4 J. of Envtl. Econ. and Mgmt. 247, 247-254 (1976); 1.38, George S. Tolley, *Welfare Economics of City Bigness*, 1 J. of Urban Econ. 324, 324-345 (1974); 1.28, George S. Tolley, R.N.S. Harris and C. Harrell, *The Residence Site Choice*, 50 Review of Econ. and Statistics 241, 241-247 (1968); 0.10, George S. Tolley & Douglas Diamond, Jr., “The Economics of Urban Amenities,” (New York, NY: Academic Press, 1982).

II. BACKGROUND AND SUMMARY OF SUPPLEMENTAL TESTIMONY

Q4. Prior to the October 22, 2012 hearing on New York State (“NYS”) Contention 17/17A/17B (jointly, “NYS-17B” unless otherwise noted), Entergy disclosed a supplemental hedonic analysis of property values near Indian Point, later designated as Entergy Exhibit ENT000590. Are you familiar with that exhibit?

A4. (GST) Yes. Exhibit ENT000590 contains the results of a hedonic regression analysis that I performed on the Assessor data set that Dr. Sheppard assembled and used to perform his repeat-sales analysis.

Q5. Why did you prepare that analysis?

A5. (GST) I prepared that analysis to respond to certain criticisms first made by Dr. Sheppard in his June 2012 rebuttal to my March 2012 report. *See* Pre-Filed Written Rebuttal Testimony of Stephen C. Sheppard Regarding of Contention NYS-17B (Jun. 28, 2012) (“Sheppard Rebuttal Testimony”) (NYS000434); George S. Tolley, Property Value Effects of Indian Point License Renewal (Mar. 2012) (“Tolley Report”) (ENT000144). To understand this, it helps to start with my original March 2012 report, setting the stage for Dr. Sheppard’s rebuttal criticisms.

Q6. To place your analysis in Entergy Exhibit ENT000590 in context, briefly summarize the relevant aspects of your March 2012 report.

A6. (GST) My March 2012 report contained *two* hedonic regression analyses—one which used the Multiple Listing Service (“MLS”) data set I assembled, and a second which used the same Assessor data set that Dr. Sheppard assembled and used for his repeat-sales analysis, but which also contains information that can be used to perform a hedonic regression. *See* Tolley Report at 15-22, 48-50 (ENT000144); Testimony of Entergy Witnesses Donald P. Cleary, C. William Reamer, and George S. Tolley Regarding Contention NYS-17B (Property Values) at 70-78, 129-131 (Mar. 28, 2012) (“Entergy Testimony”) (ENT000132). To estimate the potential relationship between proximity to the Indian Point site and property values, I originally used one of the most commonly-used functional forms for this type of analysis, the “quadratic” functional form, which considers together both the linear distance to Indian Point and distance squared. These MLS and Assessor quadratic form assessments both suggest that proximity to Indian Point has no discernible adverse impact on residential property values, a conclusion that is consistent with other studies of nuclear power plants that I cite in my March 2012 report. *See* Tolley Report at 9-12, 14 (ENT000144).

Along with the quadratic functional form, I originally considered a reasonable set of other functional forms consistent with established literature in the field to determine whether adverse property value impacts are associated with Indian Point. As indicated in my original report, I performed sensitivity analyses using alternative functional forms on both the MLS and Assessor data sets. Specifically, as I stated in my report: “Sensitivity tests were run with alternative functional forms (log-log, semi-log, linear form without distance squared) that did not change the conclusion.” Tolley Report at 22, 49 (ENT000144). Based on my review of studies at other

nuclear sites as well as the two hedonic regression analyses that I conducted, I concluded that the most likely estimate of the effect of proximity to the Indian Point on residential property values is zero, even when taking into account Dr. Sheppard's original testimony and associated report.

Additionally, based on the extensive literature demonstrating that local taxes have a significant impact on residential property values and also based on the coefficients of the payment-in-lieu-of-taxes ("PILOT") variable included in the two hedonic regression analyses, I concluded that Indian Point's PILOT distributions have a positive impact on property values. Moreover, I also demonstrated the importance of appropriately considering the difference between PILOT distributions under license renewal and under the no-action alternative, the long-term decommissioning timeframe, and discount rates. When those factors are appropriately considered, I demonstrated that the magnitude of the property value effects alleged by Dr. Sheppard is very small relative to the positive property value effects of PILOT payments. In large part, this is because PILOT losses would take place once operations cease and thus are less heavily discounted than Dr. Sheppard's alleged property value impact, the effects of which would not be fully realized for decades after operations cease. As such, even assuming the occurrence of Dr. Sheppard's \$1.07 billion asserted property value gain based on his repeat-sales analysis, license renewal results in a net positive property value impact compared to the no-action alternative because lost PILOT payments in the near-term outweigh Dr. Sheppard's alleged property value increase in the distant future. Tolley Report at 53-54 (ENT000144).

Q7. With that background on your original report, why did you perform the analysis in Entergy Exhibit ENT000590?

A7. (GST) In his rebuttal testimony, Dr. Sheppard focused on my MLS data set results, ignoring my similar analyses based on his Assessor data set, and suggested that my *MLS*

data set hedonic analysis should have considered alternatives to the quadratic functional form. In particular, Dr. Sheppard claimed that applying the square root of distance functional form to my MLS data set produced statistically-significant results and an estimate of adverse property value impacts that was similar to his repeat-sales property value impact estimate. *See* Sheppard Rebuttal Testimony at 36-38 (NYS000434). What bears emphasis here is that Dr. Sheppard performed this analysis on only one of the two available data sets.

In response, I performed the regression analysis in Exhibit ENT000590 that uses the square root of distance as yet another functional form because I wanted to see whether Dr. Sheppard's claims about the square root of distance functional form would have any foundation if he had worked from his *Assessor* data set. The regression I performed was otherwise identical to the Assessor hedonic analysis described in my original report except that I applied to the Assessor data set the square root of distance functional form suggested by Dr. Sheppard, instead of the quadratic functional form. I performed this new analysis even though well-established, state-of-the-practice economic analysis does not suggest or involve using the square root of distance functional form in hedonic regression analysis. As I briefly noted during the hearing, hedonic regression analysis is widely used by economists, but based on my research of the extensive literature applying this methodology, I located only a handful of studies, out of hundreds of previous hedonic studies, that have used the square root of distance.

Q8. Please summarize the results of your additional analysis contained in Entergy Exhibit ENT000590.

A8. (GST) I found that the Assessor data set square root of distance functional form coefficient was not statistically significant and thus does not support Dr. Sheppard's claim that Indian Point adversely impacts property values. On the other hand, as with my earlier Assessor

data set analysis, the square root of distance regression demonstrated that Entergy's PILOT distributions have a statistically-significant positive impact on property values. In light of these results, it would be unreasonable and contrary to established economic practice to conclude that Indian Point has an adverse impact on property values based on the MLS data set square root of distance results. Not only is the square root of distance a highly-unusual functional form, but the MLS square root of distance results are inconsistent with the Assessor square root of distance results, the MLS and Assessor quadratic results, and the results of previous studies of other nuclear power plants, which all suggest that Indian Point has no significant negative impacts on residential property values.

Q9. Are you familiar with the New York Exhibit NYS000446, entitled "Analysis by Stephen C. Sheppard Using Tolley MLS Linear Square Root"?

A9. (GST) Yes. My understanding is that New York disclosed Exhibit NYS000446 on Saturday, October 20, 2012, at approximately 9 p.m., partially in response to ENT000590. The hearing on Contention NYS-17B started on Monday, October 22, 2012, so I only had a brief opportunity to review Exhibit NYS000446 before the hearing commenced. At the hearing, Dr. Sheppard provided testimony on the analyses he performed in Exhibit NYS000446. *See* Tr. 2668-72, 2677-92, 2693-2703 (Oct. 22, 2012). After the hearing, upon returning to my office in Chicago, I have since had the opportunity to more fully evaluate Exhibit NYS000446 and Dr. Sheppard's associated testimony.

Q10. Were Dr. Sheppard's analyses responsive to the analysis you performed in Entergy Exhibit ENT000590?

A10. (GST) No. The first two pages of Exhibit NYS000446 contain four tables that present the results of statistical hedonic regressions that Dr. Sheppard performed on the *MLS*

data set. The four tables present four different functional forms used to estimate the relationship between proximity to the Indian Point site and property values. Specifically, Exhibit NYS000446 presents the following functional forms: (1) quadratic (the form used in my report); (2) linear; (3) square root of distance (the form Dr. Sheppard focused on in his rebuttal); and (4) distance squared. As just explained, my new analysis in Exhibit ENT000590 sought to address whether Dr. Sheppard's *Assessor* data set supported Dr. Sheppard's claims about the square root of distance functional form. Dr. Sheppard's new analysis in Exhibit NYS000446 does not respond to that question or contain any hedonic analysis of his own Assessor data set, even though that data set contains sufficient information to perform such an analysis. Instead, Dr. Sheppard turned back to the MLS data set, focused on additional functional forms that were not the focus of his rebuttal testimony nor raised by Exhibit ENT000590. Instead, Dr. Sheppard simply performed analyses that could easily have been included in his rebuttal. Therefore, the first two pages of Exhibit NYS000446 are not responsive to my new analysis in Exhibit ENT000590 that focused on only the Assessor data set and which focused on the single functional form—square root of distance—that was the focus of Dr. Sheppard's critique.

The last two pages of New York Exhibit NYS000446 contain three tables that present the results of repeat-sales statistical regressions, another wholly new analysis unrelated to Exhibit ENT000590, that Dr. Sheppard recently performed. Again, it bears noting that this whole analysis could have been presented as part of his original rebuttal. Nevertheless, Dr. Sheppard again attempts to show that Indian Point Unit 2 and 3 ("IP2" and "IP3," respectively; collectively "Indian Point" or "IPEC") commencing full power operations in the period from 1974 to 1976 constituted an "event" that lowered the annual nominal return for observed sets of real estate transactions. The first table presents the results of the original analysis Dr. Sheppard submitted

in December 2011. *See* Tr. at 2686. In the second table, Dr. Sheppard performs the same regression analysis except Dr. Sheppard removed 289 observations that were incorrectly included in his original analysis because these observations involved a pair of transactions where one sale price corresponded to a vacant lot and the other sale corresponded to a completed residence. Tr. at 2686-2687. This was a partial response to the criticism I raised in March 2012, before his original rebuttal, regarding the very large number of errors that resulted in 425 observations being incorrectly included in Dr. Sheppard’s original sample. *See* Entergy Testimony at 114-116 (ENT000132); Tolley Report at 56 (ENT000144). In the third table, Dr. Sheppard performs another regression analysis with the 289 vacant lot observations removed, but also adds indicator/dummy variables as an attempt to account for two housing bubbles that substantially biased the comparison between his “treatment” and “control” groups. Tr. 2688, 2691-2692. This again was a partial response to the criticism I raised in March 2012—not in Exhibit ENT000590—regarding Dr. Sheppard’s failure to use a realistic control group. *See* Entergy Testimony at 116-123 (ENT000132); Tolley Report at 38-44 (ENT000144). Thus, the last two pages of Exhibit NYS000446 are not responsive to my analysis in Exhibit ENT000590, but instead constitute a belated (and incomplete) response to issues I raised in March 2012.

Q11. In preparing this supplemental testimony, have you relied upon any new materials?

A11. (GST) Yes. I have relied upon an article by Raymond Palmquist, entitled *Measuring Environmental Effects on Property Values Without Hedonic Regressions*, 11 J. of Urban Econ. 333 (1982) (“Palmquist Article”) (ENT000593), which was disclosed by New York in October 2012. Based on my review of Exhibit NYS000446, I also reanalyzed Dr. Sheppard’s Assessor data set as discussed in Questions 31 and 33 below, and prepared a document entitled

“Examples of Errors Remaining in Dr. Sheppard’s Assessor Data Set” (Nov. 2012) (ENT000594) and Table 1 entitled “Assessors Card Data Regressions” presented in Section IV below.

Q12. I show you Entergy Exhibits ENT000593 and ENT000594. Do you recognize these documents?

A12. (GST) Yes. These are true and accurate copies of the documents that I have referred to, used and/or relied upon in preparing this supplemental testimony.

Q13. How do these documents relate to the work that you do as an expert in forming opinions such as those contained in this testimony?

A13. (GST) These documents represent the type of information that a person within my field of expertise reasonably relies upon in forming opinions of the type offered in this testimony.

Q14. Please summarize your supplemental testimony concerning New York Exhibit NYS000446 and Dr. Sheppard’s associated testimony.

A14. (GST) As discussed below in more detail in Section III, Dr. Sheppard erroneously claims that alternative hedonic functional forms are consistent with his repeat-sales analysis. First, his interpretation of the quadratic results are at odds with common sense and everyday economic behavior, and thus must be rejected as being caused by an omitted, non-Indian Point variable. Second, Dr. Sheppard’s focus on the rare square root of distance functional form can fairly be characterized as “cherry picking” a functional form to support a preconceived hypothesis and should not be taken as evidence that proximity to the Indian Point site depresses property values. Third, the square of distance functional form as a measure of the effect of proximity to the plant is illogical and contrary to both common sense and economic

theory because any disamenity becomes a lesser concern—not a greater concern—at greater distances. Fourth, Dr. Sheppard misinterprets the linear term result which only is statistically significant because the regression is picking up the effect of the omitted squared term, an error made all the more indefensible because even positing a significant square term relationship is illogical, as noted in point three.

Next, as discussed below in greater detail in Section IV, Dr. Sheppard's alterations to his repeat-sales analysis fail to cure the flaws I raised in my March 2012 report. First, Dr. Sheppard's new repeat-sales analysis is still built on a data set that has numerous incorrectly-included observations that do not represent arm's length market transactions of residential properties. Second, Dr. Sheppard's analysis still violates the most fundamental requirements for a valid repeat-sales study, including the need for housing characteristics and other factors affecting returns to remain unchanged between sales. Dr. Sheppard could not correct for these methodological flaws by simply adding an indicator/dummy variable to address housing bubbles, and, even in trying to do so, he did not do that correctly, because he failed to address differences in holding periods between the treatment and control groups that continue to bias his results.

Finally, and perhaps most importantly, even if one assumed for the sake of argument that Dr. Sheppard's new analyses were correct and supported his claim of a billion-dollar property value impact, my original conclusion remains unchanged—license renewal results in a net positive property value impact compared to the no-action alternative because the near-term loss of PILOT payments outweighs Dr. Sheppard's alleged property value impacts that would purportedly occur many decades in the future. Specifically, when the difference between PILOT distributions under license renewal and under the no-action alternative, the decommissioning timeframe, and reasonable discount rates are all appropriately considered, the magnitude of the

property value effects alleged by Dr. Sheppard is very small relative to the positive property value effects of PILOT payments.

III. DR. SHEPPARD ERRONEOUSLY CLAIMS THAT ALTERNATIVE HEDONIC FUNCTIONAL FORMS ARE CONSISTENT WITH HIS REPEAT-SALES ANALYSIS

Q15. Please provide an overview of the regression results on the first two pages of New York Exhibit NYS000446 and Dr. Sheppard's associated testimony.

A15. (GST) As noted above in response to Question 10, the first two pages of Exhibit NYS000446 contain four tables that present the results of statistical hedonic regressions that Dr. Sheppard performed on the MLS data set. The four tables present four different functional forms: (1) quadratic; (2) linear; (3) square root of distance; and (4) distance squared. According to Dr. Sheppard, the results of all four of these functional form regressions are consistent with each other and show that Indian Point is a statistically-significant disamenity because property values increase as you move farther away from Indian Point. Tr. at 2669, 2684. Dr. Sheppard further claims that the magnitude of the property value impact found by applying these various functional forms to the MLS data set is approximately the same as the impact that Dr. Sheppard found using his repeat-sales methodology. Tr. at 2668, 2678.

Q16. Does your review of the first two pages of New York Exhibit NYS000446 and Dr. Sheppard's associated testimony cause you to question your selection of the quadratic functional form or the conclusions you reach on the lack of property value-driven offsite land use impacts due to the presence of IP2 and IP3?

A16. (GST) No. My selection of the quadratic functional form was sound and based on common sense and well-accepted economic theory. If Indian Point were a disamenity or nuisance that has an adverse property value impact, as New York alleges, one would expect that: (1) property values would increase moving away from the plant; and (2) this negative impact

would be lessened farther away from the plant and eventually, at some maximum distance, there would no longer be a negative impact. This is common sense because the alleged disamenity would gradually diminish as the plant becomes a lesser concern at greater distances. For this reason, the quadratic functional form is one of the most commonly-used functional forms for this type of analysis and should capture such a relationship if Indian Point were in fact a disamenity.

As explained in my March 2012 report, the results of the MLS data set hedonic regression using the quadratic functional form are anomalous for two reasons. *See* Tolley Report at 75-76 (ENT000144). First, taken uncritically, the results suggest that proximity to Indian Point is an amenity within 1.99 miles of the plant (*i.e.*, property values increase as one moves closer to the plant). Second, taken uncritically, the results suggest that proximity to Indian Point is a disamenity beyond 1.99 miles of the plant, and that the disamenity impact becomes increasingly strong the farther one moves away from the Indian Point site. With regard to this latter point, taken uncritically, these results suggest that if you move a house situated 2 miles away from the Indian Point site to 3 miles away from the Indian Point site, the value would increase \$20,000; if you move that same house another mile away from the Indian Point site, from 3 miles to 4 miles away, the value would increase another \$60,000 (a \$80,000 total increase); and if you move that same house another mile away from the Indian Point site, from 4 miles to 5 miles away, the value would increase another \$100,000 (an \$180,000 total increase). The increasing strength of the effect as distance increases is completely contrary to the well-understood principle that any disamenity becomes a lesser concern—not a greater concern—at greater distances.

These results clearly suggest the presence of some unobserved variable—some other non-Indian Point amenity or disamenity—that is influencing property values in the area. The presence of an unobserved variable is not uncommon in hedonic analyses. No evidence exists,

however, that this unobserved variable is somehow masking a large significant adverse Indian Point property value impact. Thus, in my expert opinion, it would be unreasonable to interpret these results as supporting Dr. Sheppard's claim that Indian Point is having a significant adverse property value impact.

Furthermore, when I applied the quadratic functional form to Dr. Sheppard's Assessor data set, neither the linear distance term nor the squared distance term defining the quadratic function was statistically significant. Therefore, application of the quadratic form to the Assessor data set fails to support to Dr. Sheppard's claim that Indian Point has a significant adverse property value impact.

Q17. Dr. Sheppard claims that the anomalous quadratic results presented in New York Exhibit NYS000446 can be explained by Indian Point workers wanting to live near the facility. Please explain whether you agree with this claim.

A17. (GST) I do not agree with Dr. Sheppard's claim. Although Dr. Sheppard speculates that the positive property value impact within 1.99 miles might be caused by Indian Point workers wanting to live near the facility, there simply are not enough Indian Point workers for them to cause any observable property value impact through the worker demand he hypothesizes. *See* Tr. at 2597-2598. More importantly, Dr. Sheppard's theory would only explain why Indian Point is an amenity within 1.99 miles of the facility, but would not explain why Indian Point would become an increasingly-strong disamenity the farther one moves away from the facility. Such a result is illogical because the purported Indian Point physical impacts identified by Dr. Sheppard (*e.g.*, noise and traffic) decrease—not increase—as you move farther away from the plant. Therefore, it would be unreasonable to conclude that the anomalous result found when the quadratic functional form is applied to the MLS data set supports Dr. Sheppard's

claim that Indian Point is having a significant adverse property value impact.

Q18. Based on the other hedonic regression results in New York Exhibit NYS000446, Dr. Sheppard claims that alternative functional forms indicate that Indian Point has a significant adverse property value impact. Before Dr. Sheppard performed his new analyses in October 2012, did you consider using alternative functional forms instead of the quadratic functional form?

A18. (GST) Yes. As indicated in my original report, I performed sensitivity analyses using alternative functional forms on *both* the MLS *and* the Assessor data sets, and those analyses did not change my conclusion that Indian Point does not have a significant adverse property value impact. Tolley Report at 22, 49 (ENT000144). These sensitivity analyses examining alternative ways to estimate the relationship between proximity to the Indian Point site and property values produced results that were either not statistically significant, had anomalies similar to the MLS quadratic results, or resulted in unreasonably large and illogical disamenity effects. Thus, I considered a reasonable set of functional forms for determining whether Indian Point has a significant adverse property value impact.

Q19. In New York Exhibit NYS000446 and the associated testimony, Dr. Sheppard claims that the square root of distance functional form is an alternative functional form that you should have considered and shows that property values increase as you move farther away from IPEC. See Analysis by Stephen C. Sheppard Using Tolley MLS Linear Square Root at 1-2 (Oct. 2012) (NYS000446); Tr. at 2601-02. Please explain whether you agree with this claim.

A19. (GST) I do not agree with Dr. Sheppard's claim. As previously noted in response to Question 7, well-established, state-of-the-practice economic analysis does not involve using

the square root of distance functional form in hedonic regression analysis. Furthermore, as previously noted in response to Question 8, I applied the square root of distance functional form to the Assessor data set and found that in such analysis the distance functional form coefficient was not statistically significant and thus does not support Dr. Sheppard's claim that Indian Point adversely impacts property values. Thus, it would be unreasonable to conclude that Indian Point has an adverse impact on property values based on the square root of distance functional form analysis performed on a single data set.

Q20. In New York Exhibit NYS000446 and the associated testimony, Dr. Sheppard claims that the linear functional form is actually the most commonly-used hedonic functional forms and shows that proximity to Indian Point causes a decline in property values. See Analysis by Stephen C. Sheppard Using Tolley MLS Linear Square Root at 1 (Oct. 2012) (NYS000446); Tr. at 2628, 2682-83. Please explain whether you agree with this claim.

A20. (GST) I do not agree with Dr. Sheppard's claim. Although the linear distance form is a common functional form in the general hedonic literature, the great majority of these studies use the linear functional form in a measurement of the distance from each property to the central business district of an urban area. The reason to do so is that the distance variable in these studies is capturing the costs of travel to work and shopping amenities. Although the linear form is appropriate in such cases where the effect is due to simple travel cost outlay, in my opinion it is not appropriate here, where the effect of distance being estimated is the distance to an alleged disamenity such as a power generation facility and where the well-known effect of diminishing marginal utility comes into play. In other words, the importance of the effect of proximity to the power generation facility decreases with distance.

I also do not agree with Dr. Sheppard's claim that the results from the linear distance functional form demonstrate that proximity to Indian Point causes a decline in property values. As discussed in my March 2012 report, the linear distance term is not statistically significant when included with the distance squared term in the quadratic form. Although the linear term becomes statistically significant when it is included alone without a squared term, the linear term only becomes statistically significant because it is picking up the effect of the omitted squared term. In other words, the effect of the squared term is masked and attributed to the linear term. Because the squared term's statistical significance is due to omitted variables not associated with the effect of proximity of the plant (as I discussed in response to Question 16), the linear distance term likewise is also associated with an omitted, non-Indian Point variable. Accordingly, it would be unreasonable to interpret the linear distance results as supporting Dr. Sheppard's claim that Indian Point is having a significant adverse property value impact.

Furthermore, Dr. Sheppard's linear distance functional form using the MLS data set should also be rejected because it leads to unreasonably large and illogical disamenity effects. Taken uncritically, these results suggest that if you move a house from 2 miles away from the Indian Point site to 3 miles away from the Indian Point site, the value would increase by \$47,000; if you move that same house from 2 miles to 5 miles away from the Indian Point site, the value would increase by \$141,000; and if you move that same house from 2 miles to 10 miles away from the Indian Point site, the value would increase by \$376,000. These are unreasonably large impacts to project when the mean asking price in the MLS sample was approximately \$364,000, and where the functional form does not show that this negative impact is lessened farther away from the plant. In sum, these results defy common sense and accepted economic theory, and thus do

not support Dr. Sheppard's claim that Indian Point is having a significant adverse property value impact.

Q21. In New York Exhibit NYS000446 and the associated testimony, Dr. Sheppard claims that the square of distance functional form is an alternative functional form that you should have considered and shows that property values increase as you move farther away from IPEC. See Analysis by Stephen C. Sheppard Using Tolley MLS Linear Square Root at 2 (Oct. 2012) (NYS000446); Tr. at 2684-85. Please explain whether you agree with this claim.

A21. (GST) I do not agree with Dr. Sheppard's claim. Selection of the square of distance functional form is illogical and contrary to common sense and economic theory. Dr. Sheppard again ignores the fact that applying this functional form means Indian Point would become an increasingly-strong disamenity the farther one moves away from Indian Point. As previously noted above in discussing the MLS quadratic functional form, the idea of a disamenity that becomes increasingly strong with distance is illogical because physical impacts such as noise and traffic decrease, not increase, as you move farther away from the plant. As such, the results of applying the square of distance functional form to the MLS data set do not support the hypothesis that Indian Point adversely impacts property values because there is no logical reason for the strength of the disamenity effect to increase the farther a property is from the plant.

Q22. According to Dr. Sheppard, the quadratic, the linear, the square root of distance, and the square of distance functional forms presented in New York Exhibit NYS000446 are all consistent with one another and show that Indian Point adversely impacts property values. See Tr. at 2681-85. Please explain whether you agree with Dr. Sheppard on this point.

A22. (GST) I do not agree with Dr. Sheppard's claim. For the reasons discussed in response to Questions 16 to 17, the quadratic results are at odds with common sense and everyday economic behavior, and thus must be rejected as being caused by an omitted, non-Indian Point variable. *See also* Tolley Report at 21-22 (ENT000144).

Furthermore, as discussed in response to Question 19 and, as I was able to only briefly discuss during the hearing, the square root of distance functional form is very rarely used and, when applied to the Assessor dataset, does not show proximity to Indian Point adversely affects property values. *See* Tr. at 2608-10. Based on my research, Dr. Sheppard has never used the square root of distance form in his own published hedonic work. Nor did the undergraduate student that Dr. Sheppard advised, who conducted the nuclear power plant hedonic study referenced in Dr. Sheppard's testimony, use the square root of distance form. *See generally* B. Prest, *Measuring the Externalities of Nuclear Power*, unpublished thesis, Williams College, (May, 14, 2009) ("Prest Study") (NYS000232). As such, the square root of distance functional form does not support Dr. Sheppard's preconceived hypothesis and should not be taken as evidence to conclude that proximity to the Indian Point site depresses property values.

Moreover, as I explained in response to Question 20, the linear term only becomes statistically significant because it is picking up the effect of the omitted squared term. Thus, as with the square of distance results, it would be unreasonable to interpret the linear distance

results as supporting Dr. Sheppard's claim that Indian Point is having a significant adverse property value impact.

Q23. According to Dr. Sheppard, the quadratic, the linear, the square root of distance, and the square of distance functional forms presented in New York Exhibit NYS000446 are all consistent with the results of his repeat-sales analysis. See Tr. at 2681-85. Do you agree?

A23. (GST) No. As an initial matter, Dr. Sheppard's hedonic calculations are based only on the square root of distance results from the MLS data set. If Dr. Sheppard had based his calculations on his own Assessor data set, with the lower (and non-statistically significant) square root of distance coefficient, then the estimated property value impact would have been approximately one-third of his repeat-sales impact estimate.

It also is important to recognize that Dr. Sheppard's repeat-sales analysis remains invalid for numerous reasons already stated in Section 6 of my report. See Tolley Report at 35-54 (ENT000144). As discussed below in Section V, his repeat-sales analysis remains invalid notwithstanding his belated attempt in Exhibit NYS000446 to cure a few of the criticisms I raised in March 2012. Thus, even if the hedonic regression analyses were consistent with the results of the repeat-sales analysis, that is nothing more than consistency with a meaningless number.

Q24. Assuming for the sake of argument that Dr. Sheppard was correct and that the hedonic calculations he is now relying upon based on New York Exhibit NYS000446 actually support his \$1.07 billion property value increase claim, would that change your conclusion that license renewal results in a net positive property value impact to the local communities surrounding Indian Point when compared to the no-action alternative?

A24. (GST) No. Whether the billion-dollar asserted property value impact is derived from Dr. Sheppard's misinterpretation of the hedonic regression analyses or from his flawed repeat-sales analyses, my conclusion remains unchanged—license renewal results in a net positive property value impact compared to the no-action alternative because the near-term loss of PILOT payments outweighs Dr. Sheppard's alleged property value impacts that would occur many decades in the future. Specifically, when the difference between PILOT distributions under license renewal and under the no-action alternative, the long-term decommissioning timeframe, and discount rates are all appropriately considered, the magnitude of the property value effects alleged by Dr. Sheppard is very small relative to the much more quickly-felt positive property value effects of PILOT payments. In large part, this is because PILOT losses would take place once operations cease and thus are less heavily discounted than Dr. Sheppard's alleged property value impact, the effects of which would not be fully realized for decades after operations cease. As such, even assuming a \$1.07 billion asserted property value gain, license renewal results in a net positive property value impact compared to the no-action alternative because lost PILOT payments in the near-term outweigh Dr. Sheppard's alleged property value increase. Tolley Report at 53-54 (ENT000144).

Q25. Is your conclusion that Dr. Sheppard's new hedonic impact calculations are swamped by the PILOT impacts altered by Dr. Sheppard's claim that the 60-year decommissioning timeframe is not relevant because his alleged positive property value impacts would take place within the first 10 years following the cessation of operations? See Tr. at 2638-40.

A25. (GST) No. Dr. Sheppard speculates that positive property value impacts resulting from the no-action alternative may begin to take place within 10 years of cessation of operations, but he points to no data connecting any physical changes associated with Indian Point to this timeframe for property values changes. Tr. at 2640. Dr. Sheppard appears to justify this 10-year recovery period by pointing to the Assessor data set average duration of home ownership, *see* Tr. at 2639, but there is absolutely no logical reason to believe there is any relationship between that data point and the property value recovery period. Further, Dr. Sheppard inexplicably ignores the long-term decommissioning process and the fact that, even if decommissioning were completed in less than 60 years, the industrial character in the area as well as Indian Point's spent fuel and spent fuel storage-related structures are likely to remain in place for decades. Tr. 2617, 2636, 2709. Therefore, Dr. Sheppard fails to justify his 10-year recovery period or show that it is appropriate to completely ignore these other factors when considering the potential for future property value changes.

IV. DR. SHEPPARD'S ALTERATIONS TO HIS REPEAT-SALES ANALYSIS FAIL TO CURE THE MAJOR FLAWS DR. TOLLEY RAISED IN MARCH 2012

Q26. Please provide an overview of the regression results on the last two pages of New York Exhibit NYS000446 and Dr. Sheppard's associated testimony.

A26. (GST) As I mentioned in response to Question 10, the last two pages of Exhibit NYS000446 contain three tables that present the results of repeat-sales statistical regressions that

Dr. Sheppard recently performed in an attempt to show that IP2 and IP3 commencing full power operations in the period from 1974 to 1976 constituted an “event” that lowered the annual nominal return for observed sets of real estate transactions.

Q27. What does the first table show?

A27. (GST) The first table presents the result of the original analysis Dr. Sheppard submitted in December 2011. *See* Tr. at 2686.

Q28. What does the second table show?

A28. (GST) In the second table, Dr. Sheppard performs the same regression analysis except that Dr. Sheppard removed 289 invalid observations from the analysis because those observations involved a sale of a vacant lot in one transaction and a sale of a completed residence in the other transaction in the calculation of rate of return, and thus were incorrectly included in his original analysis. Tr. at 2686-2687. This was a partial response to the criticism I raised in March 2012 regarding the large number of errors that resulted in 425 observations being incorrectly included in Dr. Sheppard’s sample. *See* Entergy Testimony at 114-116 (ENT000132); Tolley Report at 56 (ENT000144).

Q29. What does the third table show?

A29. (GST) In the third table, Dr. Sheppard performs another regression analysis with the 289 vacant lot observations removed, but he also adds indicator/dummy variables as an attempt to account for two large housing bubbles that biased the comparison between his “treatment” and “control” groups. Tr. 2688, 2691-2692. This again was a partial response to the criticism I raised in March 2012 regarding Dr. Sheppard’s failure to use a realistic control group. *See* Entergy Testimony at 116-123 (ENT000132); Tolley Report at 38-44 (ENT000144).

Q30. In New York Exhibit NYS000446 and the associated testimony, Dr. Sheppard claims the removal of vacant lot data appropriately responds to the critique you raised in March 2012 regarding the extraordinary number of errors in his December 2011 repeat-sales analysis. See Tr. at 2698-2700. Please explain whether Dr. Sheppard has appropriately addressed your critique.

A30. (GST) Dr. Sheppard still has not fully responded to my criticisms that his work contained an extraordinary number of obvious errors that should have caused him to exclude various observations from his sample. Entergy Testimony at 114-116 (ENT000132); Tolley Report at 37-38 (ENT000144). Although I noted that the most common and obvious error was Dr. Sheppard's improper inclusion of observations that involved a pair of transactions where one sale price corresponded to a vacant lot and the other sale corresponded to a completed residence, there were ten other types of errors which he has not corrected. Dr. Sheppard received information during the discovery process that clearly identifies these other improperly-included observations and explains why each of these observations should be excluded. At the hearing, Dr. Sheppard conceded that approximately 135 observations that I objected to were still left in his analysis presented in Exhibit NYS000446. This constitutes more than 10 percent of the remaining sample. This error rate is still too high and still makes it inappropriate to rely on Dr. Sheppard's analysis.

Q31. Dr. Sheppard disagreed with your characterization of these other problems and argued that many of these Assessor card errors were actually corrected through other data sources such as through information from the Office of Real Property Services. See Tr. at 2699-2700. Did Dr. Sheppard use supplemental information to correct all of the remaining errors in his Assessor data set?

A31. (GST) No. Dr. Sheppard's claim that supplemental information, such as information obtained from the Office of Real Property Services, was used to correct the other types of errors is unsupported. The vast majority of the approximately 135 observations that I objected to were observations that *should not have been included in the data set at all* because these sales did not represent arm's-length market transactions of residential properties. Because these observations did not represent arm's-length market transactions of residential properties, these observations could not have been "corrected" with supplemental information regarding the address, sale price, or sale date as Dr. Sheppard claims. To give some examples, Dr. Sheppard's data set still includes sales between family members, subsidized sales (for example with HUD as the buyer or seller), bank auctions, foreclosures, and commercial properties (such as a private hospital). See RCF, Economic & Financial Consulting, Examples of Errors Remaining in Dr. Sheppard's Assessor Data Set (Nov. 2012) (ENT000594).

To examine whether supplemental information could have cured the errors that I originally identified, my staff reviewed the approximately 135 observations that Dr. Sheppard failed to remove from his most recent analysis. Only about a dozen properties were marked for exclusion due to a data entry error in an address, sale price, or sale date. Although a small number of errors could conceivably have been corrected with information from the Office of Real Property Services, some of the observations with data entry errors were also ineligible for inclusion for another reason (*e.g.*, they involved a foreclosure or a commercial property). Thus, even if Dr. Sheppard had used supplemental information to correct a few of the many errors that I identified, the fact remains that approximately 10 percent of the total observations in his October 2012 data set were erroneously left in his sample; an error rate that is still too high to provide reliable results.

Q32. In New York Exhibit NYS000446 and the associated testimony, Dr. Sheppard claims that using dummy variables appropriately controls for the housing bubbles and responds to the criticism you raised in March 2012 regarding the failure of his December 2011 repeat-sale analysis to allow for differences in returns to the control group and treatment group that are unrelated to Indian Point. See Analysis by Stephen C. Sheppard Using Tolley MLS Linear Square Root at 4 (Oct. 2012) (NYS000446); Tr. at 2688-2692. Please explain whether Dr. Sheppard has appropriately addressed your critique.

A32. (GST) Dr. Sheppard's use of dummy variables to control for the two housing bubble periods does not respond to my criticism. The coefficients of Dr. Sheppard's dummy variables are estimates of how much the return to holding real estate was raised for anyone whose holding period included years in the bubble periods, regardless of whether they were a member of the treatment group or control group. Both groups had some observations that were benefited by the bubble years. Dr. Sheppard's dummy variables completely miss the basic point. The dummy variables fail to account for the fact that the control group has a greater proportion of observations with short holding periods during the bubble years. The shorter holding periods inflate the average annual returns for the control group notwithstanding Dr. Sheppard's dummy variables.

By definition, the treatment group observations had to contain a purchase before 1974. Thus, every treatment group observation's annual nominal return included years of return occurring in decades prior to the high return years of 1984-1987 and 1999-2009. Although some of these observations may have benefited from the housing bubble, average annual returns were diluted by low yearly returns in earlier years for any such treatment group observations even for

those who held into the later years of abnormally high returns. Because a great number of treatment group observations necessarily involved very long holding periods, they suffer from a depressing effect to their average annual nominal return *even if a sale took place during the housing bubbles*. Because a treatment group property had to be purchased before 1974, those sold during the 1984-1987 housing bubble were held for a minimum of 10 years and those sold during the 1999-2009 housing bubble were held for a minimum of 25 years. In each case, the high bubble year returns were diluted by the intervening low returns, thus depressing their average annual returns.

The control group observations had no requirement for the initial purchase to occur before 1974. In fact, the control group observations are concentrated in the later part of the sample, with 71 percent of control group observations corresponding to sales that occurred during the 1999-2009 period where sales prices and returns were unusually high. Because there was no restriction on the purchase date of control group properties, a great number of control group observations involved relatively short holding periods. During times of rapidly increasing housing values, average holding periods in the control group decrease as some buyers took advantage of rising home values to make quick profits.

One way to address the holding period effect is to eliminate any sales from the sample that occurred during the housing bubble periods. By doing so, all abnormal effects of the housing bubbles on returns are eliminated. I adopted this approach in my March 2012 report and showed that being in the treatment group actually raises the rate of return approximately 3.5 percent, instead of lowering it as Dr. Sheppard expects. Tolley Report at 44 (ENT000144). This is a valid, econometrically-sound approach because: (1) the purported event at issue takes place from 1974 to 1976 and thus events during the 1984-1987 and 1999-2009 are not directly relevant

to the question at hand; and (2) holding period differences between the treatment group and control group are still unaccounted for by adding housing bubble dummy variables as was done in Dr. Sheppard's latest regression.

Q33. Is there a way to control for these other effects that are not addressed by the housing bubble dummy variables?

A33. (GST) No. In my opinion, the design of Dr. Sheppard's repeat-sales study, along with the unusual characteristics of his data set, make any conclusion regarding whether Indian Point impacts property values inherently unreliable. The requirements for a valid repeat-sales study are set forth in the Palmquist Article (ENT000593). A repeat-sales study requires that "[t]he characteristics of houses other than age and environmental quality must not have changed significantly between sales." Palmquist Article at 335 (ENT000593). Dr. Sheppard's repeat-sales analysis violates this fundamental requirement because his analysis extends for many years after the supposed 1974-1976 Indian Point event and thus ignores other changes affecting the annual nominal return that will, almost necessarily, be present when one's study goes over such a long period of repeat sales. For example, in later years, well after the alleged 1974-1976 event, returns on house sales were affected by the differences in holding periods in the two groups, not to mention many other events. Such differences, however, had nothing to do with whether there was a 1974-1976 Indian Point-related effect. Thus, Dr. Sheppard has not come close to performing a valid repeat-sale study, and adding a dummy variable to address two housing bubbles does not cure that central underlying deficiency.

Nonetheless, although far from perfect, adding the length of holding period as an explanatory variable helps to correct for the difference in average annual returns due to differences in the years that properties were held. To respond to Dr. Sheppard's latest analysis

and illustrate the importance of differences in holding periods between the treatment and control groups, I added the length of holding period for each observation as an independent variable to the regression presented by Dr. Sheppard in Exhibit NYS000446. The results of this new regression are presented below in the last two columns of Table 1 below. I present these results cautiously, noting that I remain doubtful that a valid repeat-sales study could be constructed using Dr. Sheppard's methodology. These results, however, show that the conclusions in my original report are confirmed when one adds a holding period variable along with Dr. Sheppard's housing bubble dummy variables. In other words, it shows that the returns to holding property for the treatment group were actually *higher* than returns to holding property in the control group, once one accounts for the holding period effect.

Table 1. Assessors Card Data Regressions					
	-1-	-2-	-3-	-4-	-5-
Treatment Dummy	-0.029 (3.48)**	0.035 (1.81)	-0.030 (2.56)*	0.068 (4.40)**	0.102 (7.17)**
Distance to IPEC (km)	-0.018 (3.23)**	-0.035 (2.68)**	-0.015 (2.61)**	-0.017 (2.86)**	-0.012 (2.75)**
80s Bubble Dummy	-	-	0.065 (2.81)**	0.058 (2.45)*	0.071 (3.51)**
Post-98 Dummy	-	-	0.054 (4.02)**	0.07 (5.18)**	0.061 (5.44)**
Holding Period	-	-	-	-0.005 (8.83)**	-0.007 (10.95)**
Constant	0.159 (8.09)**	0.149 (3.56)**	0.112 (4.95)**	0.141 (5.93)**	0.138 (7.76)**
Observations	1511	363	1222	1222	1086
R-squared	0.01	0.02	0.03	0.06	0.11
Robust t statistics in parentheses * significant at 5%; ** significant at 1%					

The first column in Table 1 presents the regression originally contained in Dr. Sheppard's December 2011 report. The second column presents the regression originally contained in my March 2011 report that showed when you take out the two periods of abnormally high returns (*i.e.*, 1984-1987 and 1999-2009) the treatment group variable is no longer statistically significant and further suggests that returns were actually *higher* in the treatment group. The third column presents the regression Dr. Sheppard submitted in October 2012 in Exhibit NYS000446.

The fourth column presents my new regression that is otherwise identical to Dr. Sheppard's October 2012 regression, except that I added a holding period variable. The results demonstrate that being in the treatment group raises the annual rate of return 6.8 percent above the average annual return in the sample. *See* Table 1 above, Column 4, Treatment Row of 0.068. This suggests that returns were actually *higher* in the treatment group.

The fifth column presents my new regression that is otherwise identical to the fourth column, except that I also now excluded the approximately 135 observations that Dr. Sheppard erroneously kept in his October 2012 regression. The results demonstrate that being in the treatment group raises the yearly rate of return 10 percent above the average annual return in the sample. *See* Table 1 above, Column 4, Treatment Row of 0.102. This once more suggests that returns were actually *higher* in the treatment group.

Again, I caution against any reliance on Dr. Sheppard's repeat-sales method because of the serious methodological problems underlying his study's design. Nonetheless, my new regression results show that his repeat-sales study does not support his claim that Indian Point lowered nearby property values.

V. **CONCLUSION**

Q34. Please summarize whether New York Exhibit NYS000446 and Dr. Sheppard's associated testimony change any of your prior conclusions regarding Contention NYS-17B.

A34. (GST) My review of Exhibit NYS000446 and Dr. Sheppard's associated testimony does not change my conclusions regarding Contention NYS-17B. Dr. Sheppard incorrectly claims that alternative hedonic functional forms are consistent with his repeat-sales analysis. Dr. Sheppard's conclusions are contrary to common sense and well-established economic practice. Moreover, Dr. Sheppard's alterations to his repeat-sales analysis fail to cure the fundamental flaws I raised in my March 2012 report because his sample still contains numerous incorrectly-included observations and he still fails to meet the most fundamental requirements for a valid repeat-sales study. Finally, and perhaps most importantly, even if one assumed that Dr. Sheppard's new analyses were correct and supported his claim of a billion-dollar property value impact, my original conclusion remains unchanged—license renewal results in a net positive property value impact compared to the no-action alternative because the near-term lost PILOT payments outweigh Dr. Sheppard's alleged property value impacts that would occur many decades in the future.

Q35. Does this conclude your testimony?

A35. (GST) Yes.

Q36. In accordance with 28 U.S.C. § 1746, do you state under penalty of perjury that the foregoing testimony is true and correct?

A36. (GST) Yes.

Executed in accord with 10 C.F.R. § 2.304(d)

George S. Tolley
RCF Economic and Financial Consulting, Inc.
333 N Michigan Ave, Suite 804
Chicago, IL 60601
312-431-1540

November 21, 2012

DB1/71683081